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Research Article

Retrospective Comparision of Trabeculectomy with Two Different Types of Conjunctival Flaps

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Abstract

Aim: To compare the surgical outcomes of limbus versus fornix based conjunctival flaps in trabeculectomy operations.

Material and methods: Forty-two patients having limbus-based conjunctival flap (Group-1) and 42 patients having fornix-based conjunctival flap (Group-2) for trabeculectomy operation were compared retrospectively with respect to surgical success, additional interventions, use of medications, complications and bleb morphology during 12-month, postoperative period in ophthalmology clinic. Success of trabeculectomy classified accordingly to postoperative Intraocular Pressure (IOP) as complete (<18mmHg), partial (18-21mmHg) and failed (>21mmHg).

Results: No significant difference was found between the groups in terms of intraocular pressure obtained on postoperative day 1 and at week 1 and 1, 3, 6, 9 and 12 months. Trabeculectomy success at 6 and 12 months were similar in both groups. There was no difference between groups in bleb morphologies at 3 and 12 months, postoperative complications, need to additional interventions or medical therapy, revision or reoperation at the end of 12 months of follow-up.

Conclusion: In conclusion, two different conjunctival flap designs (limbus-fornix) had comparable results at trabeculectomy.

Keywords

Fornix; Glaucoma; Limbus; Trabeculectomy

Introduction

Trabeculectomy is the gold standard surgical procedure for treatment of different types of glaucoma, with a reported success rate of 60-94% [1-5]. It may be performed as a first-line treatment or when other treatment options have failed [6]. This procedure was first described as a limbus-based conjunctival flap in 1960s by Cairns and since then, several modifications of trabeculectomy have been discussed and focused on the size of the scleral flap, scleral suture manipulations creating limbal fistula, conjunctival flap design and antimetabolite usage [7-14]. Conjunctival flap design (limbal or fornix based) and its effect on trabeculectomy success and bleb morphology were discussed in previous studies which yielded different but comparable results [15-20]. In this study we aimed to compare the intraocular pressure control and the complication rates of two different conjunctival flap designs for trabeculectomy with or without MMC use during one-year postoperative period.

Materials and Methods

The medical records of patients who have had a trabeculectomy procedure between January 1998-November 2009 in our ophthalmology department were reviewed. Data were collected regarding patient demographics, glaucoma type, preoperative mean Intraocular Pressure (IOP), number of medical therapies received before the surgery, cup/disk ratio, flap design (limbal or fornix-based), antimetabolite use, postoperative IOP at week 1 and 1, 3, 6, 9 and 12 months, bleb morphology at 3 and 12 months, complications, postoperative adjunctive medical therapy if needed and additional interventions (suture manipulations, needling, 5-FU use, revision and retrabeculectomy) during one year period. Patients who had ocular trauma, intraocular surgery before trabeculectomy or laser treatment and who have not attended their scheduled clinical follow-up visit at one year were excluded.

Limbus-based procedure

A 4-0 silk traction suture was placed on the superior rectus muscle in order to have a better view of the surgical field. Upper quadrant of conjunctiva was dissected in a curvilinear fashion using Westcott scissors 8 mm away from the corneoscleral limbus with a width of 6-8 mm. Additionally, Tenon's capsule dissection was performed bluntly or sharply when needed, 2 mm in front of conjunctival incision. Conjunctiva and Tenon's capsule were sutured continuously with either 8-0 polyglycolic acid, 8-0 braided lactomer or 8-0 polyglactin suture material.

Fornix-based procedure

For fornix-based procedure, a 7-0 or 8-0 polyglactin traction suture was placed to cornea. Limbal conjunctiva was dissected using Westcott scissors from its corneal detachment. Also, Tenon's capsule was removed by blunt dissection. Conjunctival flap thus obtained was turned backwards in order to visualize the surgical area.

Then, a 4x4 mm limbus-based scleral flap was fashioned using a surgical blade at halfway through the full thickness of the sclera in all surgeries. Mitomycin-C (MMC) was used for younger patients (<35y) and those who were identified to have a thick Tenon's layer intraoperatively. Three or four small surgical sponges were soaked in a 0.33 mg/ml solution of MMC, and inserted under the scleral flap for 3 minutes away from the conjunctival incision sites and then removed. The area cleansed with MMC was rinsed with 150 ml saline solution. At the edge of surgical limbus, trabecular meshwork was removed with Kelly punch or excision of a 2x1mm area. Next, peripheral iridectomy was performed, and scleral flap was closed with 2-5 10-0 nylon sutures Fornix-based conjunctival flaps were closed with a 10-0 polyglycolic acid suture.

During the postoperative period, topical tobramycin and cycloplegic agents were used for 2 weeks and topical dexamethasone for 10-12 weeks. All patients had ocular examination during the clinical visits on postoperative day 1 and 1 week later and then 1, 3, 6, 9 and 12 months.

At each examination, best corrected visual acuity, biomicroscopy, intraocular pressure by Goldmann applanation tonometry and cup/disc ratio by fundus examination were obtained for all patients. During biomicroscopic examination, Seidel's sign, bleb morphology, anterior chamber depth, transparency of the eye lens and complications (loss of anterior chamber, malignant glaucoma, choroidal effusion, hyphema, blebitis, corneal erosion) were specifically investigated. Bleb morphologies were recorded.

During follow-up, intensive steroid therapy was administered to encapsulated blebs and needling was performed when steroid therapy was inadequate. 0.1 ml of 5-fluorouracil (5-FU) (5 mg/ml), an antifibrotic agent, was injected away from the bleb every 5-7 days after the needling into the eyes with extensive fibrosis for which potential closure was anticipated in the areas exposed by needling.

While evaluating the success of trabeculectomy, patients with an intraocular pressure less than 18 mmHg as measured by Goldmann applanation tonometry at 6 months and 1 year postoperatively were classified as "complete success", those with an IOP between 18-21 mmHg as "partial success" and those with an IOP above 21 mmHg as "failure", irrespective of use of adjunctive medications.

All analyses were performed by using SPSS for Windows version 15.0 (SPSS, Inc., Chicago, IL) software. After performing normality test, the differences between continuous variables were analyzed with Student t test or Mann-Whitney U test, as appropriate. Categorical data and proportions were analyzed using Chi- square test. Two-sided p values of <0.05 were considered statistically significant.

For this study, local clinical research ethics committee (Trakya University) approval was obtained.

Results

The study enrolled 84 patients without a history of trauma or prior intraocular surgery who had a trabeculectomy operation and fully complied with postoperative follow-up visits for 12 months. Of these patients, 42 had limbus-based conjunctival flap (Group-1) and 42 had fornix-based conjunctival Flap (Group-2).

Patients in both groups were comparable with respect to mean age, preoperative average intraocular pressure, presence of any concomitant systemic illness, gender distribution and preoperative c/d ratio.

While primary open-angle glaucoma diagnosis was more common among Group-1 patients, Pseudoexfoliative (PEX)

glaucoma was more prevalent in Group-2. There were significantly more patients in Group-2 who received topical antiglaucomatous active substances preoperatively. Also, intraoperative use of antimetabolites was more common in Group-2. A summary of demographic characteristics is provided in table 1 for all patients.

No significant difference was found between the two groups in terms of mean IOP measured at postoperative day 1, week 1 and 1, 3, 6, 9 and 12 months. Postoperative IOP values are summarized in table 2.

Variable	Limbal Based Group	Fornix Based Group	P
No. of patients	42	42	
No. of eyes	42	42	
Mean Age (y)	65.52 ± 10.90	65.31 ± 10.80	0.920
Gender (female/male)	21/21	27/15	0.186
Diabetes mellitus (+/-)	6/36	7/35	0.763
Hypertension (+/-)	12/30	14/28	0.637
Left /Right eye	19/23	19/23	1.00
Glaucoma type			0.032
POAG	21 (50%)	12 (28.6%)	
ACG	7 (16.7%)	4 (9.5%)	
PEX	14 (33.3%)	26 (61.9%)	
Preop IOP (mmHg)	25.62 ± 10.31	25.72 ± 8.91	0.707
Preop cup/disc	0.74 ± 0.21	0.78 ± 0.26	0.084
Preop No. of drug			0.000
1	11 (26.2%)	2 (4.8%)	
2	9 (21.4%)	1 (2.4%)	
3	12 (28.6%)	13 (31.0%)	
4	10 (23.8%)	26 (61.9%)	

Table 1: Demographic data of groups.

Time	Limbal Based Group	Fornix Based Group	P
1st day	11.55 ± 8.69	14.12 ± 9.80	0.194
1st week	12.14 ± 6.88	14.00 ± 9.01	0.496
1st month	15.86 ± 7.26	13.48 ± 8.56	0.074
3rd month	14.07 ± 5.26	13.14 ± 6.12	0.119
6th month	14.17 ± 4.70	14.07 ± 5.85	0.753
9th month	14.36 ± 4.33	13.38 ± 6.84	0.082
12th month	14.83 ± 5.24	15.29 ± 9.50	0.527

Table 2: Postoperative Intraocular Pressure.

Bleb morphologies of both groups were compared at 3 and 12 months. There was no statistically significant difference between patients with respect to bleb morphology (p =0.767, p=0.658). The most common type of bleb was raised bleb among the groups. Bleb morphologies of patients at 3 and 12 months are summarized in table 3.

Bleb morphology	Limbal Based Group		Fornix Based Group	
	3rd month - 12th month		3rd month -12th month	
Flat	4 (9.5%)	1 (2.4%)	4 (9.5%)	2 (4.8%)
Raised	34 (81%)	34 (81%)	34 (81%)	34 (81%)
Diffuse	3 (7.1%)	6 (14.3%)	4 (9.5%)	5 (1.9%)
Encapsulate	1 (2.4%)	1 (2.4%)	0 (0%)	0 (0%)
Cystic	0 (0%)	0 (0%)	0 (0%)	1 (2.4%)

Table 3: Bleb morphology at 3th-12th month.

No statistically significant difference was found between the two groups with respect to the incidence of postoperative complications. The complications and their incidences are summarized in table 4.

No significant difference was observed between groups with respect to the number of active substances of adjunctive therapy required (p=0.507).

Complication	Limbal Based Group	Fornix Based Group	P
No Comp.	36 (85.7%)	32 (76.2%)	0.469
Choroid effusion	3 (7.1%)	2 (4.76%)	
Hyphema / coagulum	3 (7.1%)	4 (9.5%)	
Malign gloucoma	0 (0%)	2 (4.76%)	
Corneal erosion	0 (0%)	1 (2.38%)	
Hyphema / coagulum + corneal	0 (0%)	1 (2.38%)	
Erosion			
Seidel test positive	2 (4.76%)	5 (11.9%)	0.433
No. of ant chamber loss			
1	2 (4.76%)	3 (7.1%)	0.529
4	1 (2.38%)	0 (0%)	
5	0 (0%)	1 (2.4%)	

Table 4: Complication rates between groups.

In limbal based group 7 patients needed needling, fornix-based group 8 patients needed. 5-FU injection was done to 10 patients in limbal based group, and 9 patients in fornix based group. Argon laser sturolysis was done to 9 patients in limbal based group, 14 patients in fornix based group. Two cases in both group had trabeculectomy revisions. Retrabeculectomy was done to 1 patient in limbal based group and to 3 patients in fornix-based group. There was no significant difference between the groups in terms of postoperative additional interventions (average number of needling procedures, 5-fluorouracil injections, argon laser suturolysis, trabeculectomy revision, second trabeculectomy). All further interventions are summarized in table 5.

At postoperative 6 months, trabeculectomy was classified as complete success in 31 patients (73.8%), partial success in 9 patients (21.4%) and failure in 2 patients (4.8%) in Group-1. In Group-2, complete success was achieved in 32 patients (76.2%), whereas the procedure was partially successful in 6 patients (14.3%) and failed in 4 patients (9.5%). There was no significant difference between two groups in terms of trabeculectomy success at postoperative 6 months.

When we looked at the trabeculectomy success at postoperative 12 months in both groups, trabeculectomy was classified as complete success in 26 patients (61.9%), partial success in 11 patients (26.2%) and failure in 5 patients (11.9%). In Group 2, the procedure was completely successful in 35 patients (83.3%), partially successful in 5 patients (11.9%) and failed in 2 patients (4.8%). There was no statistically significant difference between two groups in terms of trabeculectomy success at postoperative 12 months.

Intervention	Limbal Based Group	Fornix Based Group	P
Needling	1.45 ± 2.56	1.05 ± 1.80	0.601
5-FU inj	1.55 ± 2.70	1.45 ± 2.65	0.829
Argon laser sturolysis			0.291
1	7 (16.7%)	10 (23.8%)	
2	1 (2.4%)	4 (9.5%)	
3	1 (2.4%)	0 (0%)	
Revision	2 (4.8%)	2 (4.8%)	1.00
Retrabeculectomy	1 (2.4%)	3 (7.1%)	0.616

Table 5: Addictive interventions in groups.

In both groups, topical antiglaucomatous agents were started for patients who have failed to achieve targeted IOP values despite trabeculectomy. Fourteen patients in limbal based group and 15 patients in fornix-based group needed additional topical antiglaucomatous at both 6th and 12th month postoperatively.

Discussion

Currently, trabeculectomy is the most commonly used surgical procedure for the treatment of glaucoma when medical therapy and laser applications fail to achieve target IOP.

While limbus-based conjunctival flap for trabeculectomy was first described in 1968 by Cairns, Luntz described fornix-based conjunctival flap in 1980 [7,21]. Since then, several modifications have been made in the trabeculectomy procedure and the size and type of the scleral flap, conjunctival flap design, intraoperative and postoperative use of antimetabolites, suture materials and adjustable suture techniques have become the focus of wide discussion [22-30].

In the present study, we compared the occurrence of complications and the success rate retrospectively among patients who underwent a trabeculectomy operation and had 1-year follow-up data (42 patients had limbus-based and 42 patients had fornix-based conjunctival flaps). We found a significant difference between two groups with respect to the type of glaucoma. While fornix-based group included more patients with pseudoexfoliative glaucoma, primary open-angle glaucoma patients were more likely to undergo limbus-based surgery. However, both patient groups were comparable in terms of preoperative IOP values. In their study, Sipahier et al., demonstrated that glaucoma type did not have an effect on the surgical success of trabeculectomy performed with limbus- or fornix-based conjunctival flap among patients with POAG, ACG, juvenile glaucoma and secondary glaucoma [31]. In contrast, Fernandez investigated patients diagnosed with POAG, PEX glaucoma and ACG in his study and found out that the surgical success was the highest among POAG glaucoma patients [32].

Accordingly, unequal distribution of glaucoma types in our patient groups might be a limitation of our study. While MMC was used for only one patient undergoing limbus-based procedure, 26 patients having fornix-based procedure had to use MMC. We believe that this may be the result of performing fornix-based procedure in a later period when MMC was being used more widely broadly. We did not include patients receiving MMC use in the statistical analysis because there was a difference between both groups with respect to the number of patients with MMC use.

The higher number of active substances of medical therapy used preoperatively by patients with fornix-based flap versus limbus-based flap was considered to result from performing the surgeries in the former group more recently at a time when there was increased availability of various medical therapy options.

We found comparable success rates in both group of patients at postoperative 6 and 12 months. We had difficulty in comparing our success rates with those reported in previous studies because different criteria were used for defining success in literature [33]. Our study is similar to that of Fontana et al., in MMC dosage used, success criteria and surgical outcomes [13].

Bleb morphology was comparable in both groups at 3 and 12 months. The most common type of bleb was raised bleb morphology in both groups. There are contradictory reports in literature for bleb morphology. In their studies, Shuster et al., and Traverso et al., obtained similar bleb morphology with two surgical methods in the absence of MMC [15,16]. In contrast to those studies, Brincker et al., reported that diffuse bleb was more common in patients with fornix-based flap and avascular bleb in patients with limbus-based flap in a study without using MMC [18]. Consistently, Agbeja and Dutton observed a greater number of diffuse blebs in patients with fornix-based flap and cystic blebs in patients with limbus-based flap following surgery without using MMC [12].

However, much variable bleb morphologies were observed when both conjunctival flaps were used in combination with MMC. A study by Wells et al., reported a higher occurrence of cystic bleb form among patients with limbus-based flaps [34]. Hirooka et al., reported avascular bleb morphology at an incidence of 31% at 12 months following 90 fornix-based trabeculectomy procedures with use of MMC [35]. On the other hand, Sacu et al., reported occurrence of cystic bleb form (incidence, 24.4%) and encapsulated bleb morphology (16.3%) at postoperative 4.45 ± 1.4 months following 49 limbus- based trabeculectomy procedures in combination with MMC [36].

In our study, we observed a lower rate of cystic or encapsulated bleb morphology in both limbus- and fornix-based flap groups in comparison to literature. This may be explained by the fact that we used MMC at a lower dose or for a shorter period of time in a small number of patients, particularly in limbus-based group and provided early intervention (steroids, needling, 5-FU) to patients who showed signs of encapsulation.

Kuroda et al., compared surgical outcomes of limbal-based versus fornix-based trabeculectomy in 26 eyes with a history of ocular incisional surgery (cataract, trabeculectomy, trabeculectomy) which had conjunctival scars [38]. They couldn't find statistical difference between two methods in regard to the probability of success, the IOP value, and the number of glaucoma eye drops after trabeculectomy. They also reported similar complication rates during a 2-year follow-up.

Al- Haddad et al., summarized 6 trials with a total of 361 participants comparing fornix-limbus based trabeculectomy in their review [38]. They noticed no difference in effectiveness between two trabeculectomy surgeries. No significant difference was found between two methods with regard to postoperative IOP measurements or number of glaucoma medications needed after surgery. A significant difference was observed in the risk of postoperative shallow anterior chamber, which was increased

in the limbal based method.

With regard to complications, variable rates were reported by aforementioned studies with use of MMC. Our study is consistent with studies conducted by Traverso and Fukuchi et al., [16,39].

We believe our study contribute to recent literature about limbal versus fornix based trabeculectomies.

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