Long-Term Results of Trabeculectomy without Antimetabolites in Low-Risk Glaucoma Cases

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ABSTRACT

Purpose: To investigate the long-term results and complications of standard trabeculectomy surgery without antimetabolites in low-risk glaucoma cases.

Materials and Methods: Patients who applied to Ankara University, Faculty of Medicine, Department of Ophthalmology and underwent standard trabeculectomy surgery were included in our retrospective study. All patients underwent a complete ophthalmic examination, including best corrected visual acuity (BCVA) with Snellen charts, slit lamp biomicroscopy, gonioscopy, Goldmann applanation tonometry, fundus ophthalmoscopy and visual field tests (Goldmann or Humphrey). Cases with intraocular pressure (IOP) of 21 mmHg and below with and without antiglaucomatous medications were successfully considered.

Results: A total of 58 eyes of 54 patients were included in the study. The mean follow-up period was 36±18.6 months. The mean preoperative IOP was 30.2±7.0 mmHg. At the end of the follow-up period, the IOP was significantly reduced to a mean of 17.9±6.1 mmHg ($p<0.001$). At the end of the follow-up period, the rate of cases with IOP below 21 mmHg with and without antiglaucomatous medications was determined as 88%. Preoperatively the mean number of topical IOP lowering medications used was 3.0±0.89 and declined to 0.86±0.94 at the last visit ($p<0.001$). The most common complication was cataract formation (7 eyes, 12%).

Conclusion: Trabeculectomy without the use of adjunctive antimetabolites appears to be highly successful in low-risk glaucoma cases over a three-year follow-up period.

Keywords: Trabeculectomy without antimetabolites, low-risk glaucoma, bleb, intraocular pressure

INTRODUCTION

Surgical procedures were developed in the 19th century to reduce the elevated intraocular pressure (IOP) in the treatment of glaucoma. The process started with the definition of sclerotomy and paracentesis by Mackenzi in 1830.[1,2] In 1968, Clarins developed the trabeculectomy procedure which is still considered the standard filtration surgery. A subconjunctival space was created to provide sufficient outflow resistance to prevent ocular collapse, thus avoiding complications seen as a result of excessive filtration observed with full-thickness filtering procedures in the early postoperative period.[3]

Trabeculectomy is indicated in cases with progressive visual field loss and glaucomatous optic disc damage despite maximum tolerated medical and laser treatment, and in cases who cannot comply with medical treatment. However, trabeculectomy may not be successful in all glaucomatous eyes. Trabeculectomy failure frequently occurs the result of subconjunctival fibrosis due to excessive postoperative wound healing. Risk factors for filtration failure after trabeculectomy include younger age, previous ocular surgery, neovascular or uveitic glaucoma, and multiple topical antiglaucomatous medication use.[4,5] Those who do not have the risk factors mentioned are considered low-risk glaucoma cases. Antimetabolites such as mitomycin C

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and 5-fluorourasil are used to prevent filtration failure after trabeculectomy. Because antimetabolites have serious side effects such as avascular cystic bleb, hipotony, and endophthalmitis, trabeculectomy without antimetabolites may be considered in low- risk cases.

The aim of the current study is to investigate the long-term outcomes and complications of standard trabeculectomy without antimetabolites in low-risk glaucoma cases.

MATERIALS AND METHODS

This retrospective study included patients followed up at the Ankara University, Faculty of Medicine, Department of Ophthalmology between January 1995 and January 2000. All patients underwent a complete ophthalmic examination, including measurement of best corrected visual acuity (BCVA), biomicroscopy, gonioscopy, Goldmann applanation tonometry, fundus ophthalmoscopy and visual field tests (Goldmann or Humphrey).

Adult patients diagnosed with primary open-angle glaucoma, angle-closure glaucoma, or pseudoexfoliative glaucoma who had progressive visual field loss and glaucomatous optic disc damage despite maximum tolerated medical and laser therapy were included in the study. Non-compliance with treatment or inability to attend follow-up, as well as failure to achieve target IOP with medical therapy, were also inclusion criteria.

High-risk cases such as congenital glaucoma, inflammatory glaucoma, neovascular glaucoma, aphakic or pseudophakic glaucoma, and a history of failed filtration surgery were excluded. Patients treated with mitomycin C, topical cyclosporine, or those undergoing combined phacoemulsification and trabeculectomy were also not included.

All trabeculectomy procedures were performed by the same experienced surgeon. The surgeries involved the preparation of a limbus-based cojunctival flap 8 mm posterior to the limbus at the 12 o'clock position. After completing the cauterization, a rectangular scleral flap with dimensions of 4x5 mm and 2/3 thickness was prepared. After resection of the trabecular block, peripheral iridectomy was performed. The scleral flap was closed with 10-0 nylon suture. The Tenon capsule was closed continuously or interrupted with 8-0 vicryl sutures and the conjunctiva was sutured continuously. At the end of the procedure, sub-conjunctival injections of dexamethasone and gentamicin were administered. The postoperative topical regimen included topical 1% atropine and antibiotics for one week and topical dexamethasone for three weeks.

At follow-up examination within the last 6 months, patients were assessed for IOP, antiglaucomatous medications use, BCVA, bleb appearance, complications and the need for additional surgery.

Bleb grading was performed according to the Moorfields bleb grading system:

-Type 1 bleb: Thin, polycystic, with high filtration.

-Type 2 bleb: Flat, diffuse , relatively avascular compared to surrounding conjunctiva, with high filtration.

-Type 3 bleb: Flat, with large superficial vessels and poor filtration due to subconjunctival fibrosis.

-Encapsulated bleb: Elevated, dome- shaped, with enlarged surface vessels and poor filtration due to hypertrophic Tenon's cyst.

Surgical success in the postoperative period was evaluated according to the following criteria:

-Successful:

1- IOP <21 mmHg without medication

2 - IOP <21 mmHg with medication

-Failure: IOP >21 mmHg despite surgical and medical treatment

For statistical analysis, paired samples t-test was used to compare preoperative and postoperative intraocular pressure values within the same group of patients. The quantitative data within the group were compared using the Wilcoxon test. A P-value <0.05 was considered as statistically significant for each of the tests.

RESULTS

A total of 58 eyes of 54 patients were included in the study. Of the patients, 26 (48.1%) were female and 28 (51.9%) were male. The mean age of the patients was 56.7±7.2 years (25-78 years). Among the eyes, 40 (68.9%) had primary open-angle glaucoma, 15 (27.5%) had pseudoexfoliative glaucoma, and 2 (3.4%) had angle-closure glaucoma.

Prior to surgery, 5 eyes (8.6%) had undergone argon laser trabeculoplasty. The study included patients operated on from January 1995 to January 2000. The mean follow-up time was 36±18.6 months (6-64 months) (table 1).

Table1. *Baseline Demographic and Clinical Characteristics of Cases*

	Mean±SD
Age (years)	56.7±7.2
Gender (F/M)	26 / 28
Follow-up (months)	36±18.6
POAG (%)	40 (68.9)
PEG (%)	16 (27.5)
ACG(%)	2 (3.4)

SD, standard deviation;POAG, primary open angle glaucoma;PEG, pseudoexfoliative glaucoma; ACG, angle closure glaucoma

The mean preoperative IOP was 30.2±7.0 mmHg. The mean postoperative IOP values were 15.2±6.3 mmHg at the first week, 15.3±6.1 mmHg at the first month, 16.4±5.9 mmHg in the first year and 17.9±6.1 mmHg at the end of the follow-up period. These reductions in IOP were statistically significant ($p<0.001$, figure 1).

Preoperatively, the mean number of antiglaucomatous medications was 3.0 ± 0.89 declined to 0.86 ± 0.94 at the last examination. This reduction was also statistically significant ($p<0.001$).

At the end of the follow-up period, IOP was below 21 mmHg without medication in 37 (63.7 %) cases, IOP was below 21 mmHg with medication in 14 (24.3%) cases, IOP was not below 21 mmHg despite trabeculectomy surgery and medical treatment in 7 (12%) cases.

At the end of the follow-up period, change in BCVA was considered significant if it was 2 or more Snellen lines. The mean BCVA increased significantly in 14 (24.2 %) eyes, unchanged in 29 (50 %) eyes, and decreased significantly in 15 (25.8 %) eyes. An improvement in visual acuity was observed in 8 eyes as a result of cataract extraction. A decrease in visual acuity was observed due to choroidal detachment in 3 patients, subretinal neovascular membrane development in 4 patients and loss of central fixation in 1 patient.

Type 1 bleb was observed in 12 (20.6%) eyes, type 2 bleb in 40 (68.9%) eyes, type 3 bleb in 4 (6.8%) eyes, and type 4 bleb in 2 (3.7%) eyes.

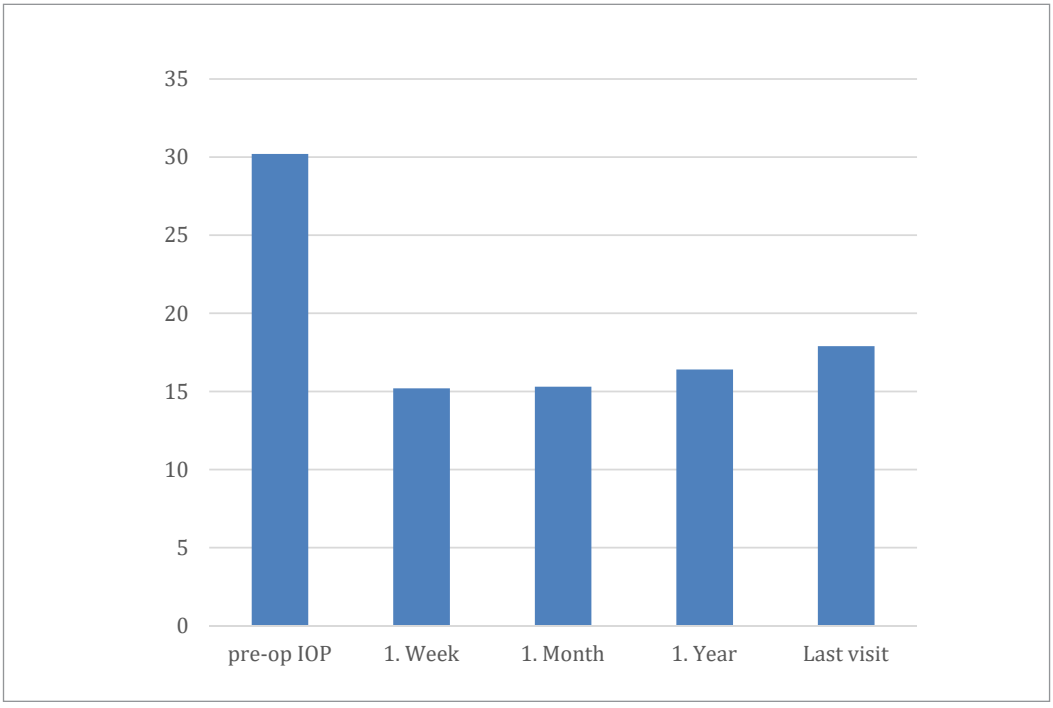

Figure 1: *Preoperative and postoperative IOP values*

Hyphema was observed in 7 (12%) eyes in the early postoperative period after trabeculectomy surgery. While hyphema regressed with medical treatment in 5 eyes, anterior chamber lavage was performed in 2 eyes. Shallow anterior chamber was observed in 5 (8.5%) eyes. In 2 of these eyes, additional sutures were placed on the scleral flap. Medical treatment was applied to the other 3 eyes. Choroidal detachment was observed in 3 (5.1%) eyes and oral steroid treatment was administered. In the late postoperative period, cataract formation was observed in 7 (12%) eyes.

DISCUSSION

The goal of filtration surgery is to achieve target IOP levels that prevent further optic nerve damage and visual field loss. Trabeculectomy surgery is a highly effective and up-to-date treatment method in cases with progressive visual field loss and glaucomatous optic disc damage despite maximum tolerated medical and laser treatment, and in cases who cannot comply with medical treatment.

Trabeculectomy was described by Cairns in 1968 and connects the anterior chamber with the sub-Tenon space, creating a continuous outflow pathway for the aqueous humor. It is still considered the gold standard today due to its effective reduction of the IOP and its cost efficiency. [6] Alternatives such as deep sclerectomy, viscocanalostomy and valve implants have been proposed to reduce the risk of postoperative complications such as hipotony and endophthalmitis.[7-9] Despite these alternative methods, trabeculectomy is still the most commonly performed surgical procedure in glaucoma cases.

The most common cause of failure in filtration surgery is scar tissue formation at the filtration site due to excessive fibrosis. Younger age, inflammatory glaucoma, neovascular glaucoma, aphakic-pseudophakic glaucoma and history of failed filtration surgery constitute the high-risk case group. In such cases, antimetabolites were introduced to improve success rates.[10] Today, antimetabolites are routinely used in trabeculectomy. However, the use of antimetabolites (especially mitomycin C) causes excessive drainage from the bleb and bleb leakage may occur even months or years after surgery. [11] Antimetabolites also have serious side effects such as avascular cystic bleb, hypotony, and endophthalmitis. Therefore, it is important to assess the individual risk status of each case when considering the use of antimetabolites. In low-risk cases, satisfactory long-term IOP control can often be achieved without additional therapy and avoiding them reduces unnecessary exposure to these risks. The literature suggests that in normal tension glaucoma patients with low-scar trabeculectomy risk, surgery combined with perioperative 5-fluorourasil can maintain an appropriate target IOP without the additional sight-threatening complications seen with additional mitomycin C. [12]

In the present study, the mean age was of 56.7±7.2 years ranging from 25 to 78 years. Only 3 cases were under 50 years of age. Therefore, all cases were considered low risk in terms of filtration surgery failure and standard trabeculectomy surgery was performed without the use of antimetabolites.

In our study, the mean IOP decreased from 30.2±7.0 mmHg at baseline to 17.9±6.1 mmHg at the end of the follow-up period and this difference was found to be statistically significant. 88% of cases achieved IOP levels below 21 mmHg with or without medication. This rate is consistent with literature studies reporting the results of trabeculectomy surgery performed without the use of antimetabolites in low-risk glaucoma cases. In a study by Bao et al., the success rate with and without medication was reported as 79.6% at the end of a 12-year follow- up period. [13] In another study conducted by Landers et al., which included 234 patients, it was reported that the success rate of trabeculectomy surgery with and without medication was 88% after a 20-year follow-up period. [14]

In the current literature, micro-invasive glaucoma surgery has been performed due to vision threatening complications such as bleb leakage, choroidal effusion and hypotony seen with trabeculectomy.[15-17] These surgical procedures aim to shunt aqueous humor across the trabecular meshwork to Schlemm's canal or the suprachoroidal space. In a study conducted in low-risk primary open-angle glaucoma cases, trabeculectomy without the use of antimetabolites was compared with micro-shunt surgery, and trabeculectomy was found to be more effective.[17]

The aim of glaucoma treatment is to determine the target IOP value that will not cause glaucomatous disc damage and visual field loss. In cases with advanced glaucomatous damage, the IOP should be reduced by 50% (target pres-

sure 8-10 mmHg).[18,19] In the light of this information, in cases with advanced damage, if the target IOP cannot be achieved with medical treatment, early surgical intervention should be considered. In our study, 17 cases (29.3%) presented with advanced optic nerve damage (C/D ratio >0.8) and significant visual defects (double arcuate, ring scotoma, small central island) were determined and early surgical treatment was planned to achieve the desired target pressure. Another indication for early surgery is cases that cannot comply with medical treatment or cannot come to regular check-ups. In our study, trabeculectomy surgery was planned in the early period in 4 (6.8%) cases due to non-compliance with medical treatment.

In the current study, the mean BCVA decreased due to increased lens opacity in 7 (12%) eyes. From the literature, cataract development after trabeculectomy surgery has been reported at different rates. In a study by Rajavi et al., increased lens opacity after trabeculectomy was seen in 9 (22%) eyes.[20] In another study, it was reported that increasing the duration of mitomycin C application increased the risk of cataract formation. [21]

In the current study, loss of central fixation was observed in 1 (1.7%) case. This case had advanced glaucomatous damage with visual field loss within 5 degrees of fixation. The incidence of central fixation loss has been reported as 1-2% in the literature. [22]

In the current study, regarding bleb morphology, functional blebs (type 1 and 2) were observed in 89.5% of subjects, correlating with the surgical success rate. Encapsulated bleb (Tenon cyst) formation was observed in 3.7% of the cases. From the literature, the average rate of encapsulated bleb developing following filtration surgery was reported to be 13%. [23,24] It mostly occurs as a result of the effect of topical antiglaucomatous treatment used in the preoperative period on the fibroblasts in the conjunctiva and episclera.

In the current study, hyphema was detected in 7 (12%) eyes the early postoperative period. In the literature, the incidence of postoperative hyphema has been reported as 7-53%.[25,26]

The limitations of this study were its retrospective design, relatively small sample size and lack of a control group trabeculectomy with antimetabolite.

In conclusion, the current study reported that in 88% of low-risk glaucoma cases, the IOP was below 21 mmHg with standard trabeculectomy without the use of adjunctive antimetabolites at the end of mean follow-up period of 3 years.

Declarations:

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