Our Combined Phacotrabeculectomy and Post-phacotrabeculectomy Laser Suture Lysis Results

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ABSTRACT

Purpose: To share our combined phacotrabeculectomy (PT) results and to evaluate the effectiveness and reliability of this procedure together with that of laser suture lysis (LSL) for postoperative early intraocular pressure (IOP) control after combined PT.

Materials and Methods: This retrospective study evaluated the 33 eyes of 30 patients who had undergone combined PT. The age, gender, glaucoma type, preoperative and postoperative best corrected visual acuity (BCVA), number of antiglaucomatous drugs, IOP, surgical complications, early postoperative LSL requirement, IOP changes after LSL, and complications after LSL were investigated.

Results: There were 18 male and 12 female patients with a mean age of 68.64±9.27 (40-86) years. The preoperative glaucoma type was most commonly pseudoexfoliative glaucoma as seen in 14 eyes and primary open angle glaucoma as seen in 12 eyes. The IOP was significantly lower ($p<0.0001$) and the BCVA significantly better ($p<0.0001$) postoperatively compared to the preoperative values. Similarly, the need for antiglaucoma drugs decreased postoperatively ($p<0.0001$). Postoperative LSL was required once in 12 eyes and twice in 4 eyes. Preoperative mean IOP was 26.75±5.4 mmHg and postoperative mean IOP was 11.31±2.96 mmHg in the eyes that underwent LSL ($p<0.0001$). No complications that threatened vision or affected surgical success were seen after LSL.

Conclusion: Combined phacotrabeculectomy is an effective and reliable surgical method in cases with glaucoma and cataract together. Suture lysis with the argon laser is an effective and reliable method in the early period to achieve target intraocular pressure after phacotrabeculectomy, and can be performed multiple times.

Key Words: Cataract, Glaucoma, Phacotrabeculectomy, Laser suture lysis.

INTRODUCTION

Glaucoma is a heterogeneous disease characterized by optic nerve head damage and visual field defects. Its global prevalence in the population aged 40-80 years is about 3.5%. It is estimated that approximately 64.3 million people in this age group were affected by glaucoma in 2013 with the number increasing to 76 million in 2020 and 112 million in 2040.[1,2] Although cataract can be seen at any age, it is mainly encountered at advanced ages. The rate of visually significant cataract that reduces visual acuity to below 20/40 has been reported as 2.5% at 40-49 years of age, 6.8% at 50-59 years of age, 20% at 60-69 years of age, 42.8% at 70-79 years of age, and 68.3% at 80 years of age.[3] Cataract treatment is surgical and the phacoemulsification (PHACO) procedure is the gold standard in the developed world.[4] Advanced age is also a known risk factor for glaucoma with the glaucoma prevalence gradually increasing with age.[5,6] Trabeculectomy was first used by Cairns in 1968 to treat glaucoma and still remains the gold standard for this disorder.[7]

The mean life expectancy is constantly increasing. There were 600 million people aged 60 or more in 2000 with this figure expected to reach 1.2 billion by 2025 and 2 billion by 2050.[8] This increase in the elderly population will also increase the incidence of disorders where age is a risk factor. Phacotrabeculectomy (PT) combines phacoemulsification and trabeculectomy to treat both cataract and glaucoma and is increasingly preferred due to its advantages such as decreased cost and duration and the use of a single anesthetic procedure.

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PT can have early postoperative complications such as excessive filtration, shallow anterior chamber, hypotonia, serous choroidal detachment, suprachoroidal hemorrhage, maculopathy, and post-trabeculectomy. Scleral flap sutures can be placed tightly during surgery to avoid excessive postoperative filtration and related complications. Cutting the scleral flap sutures transconjunctivally with a thermal laser in the postoperative period was first described by Lieberman et al. in 1983 and then by Hoskins and Migliazzo in the same year. The procedure can be used to ensure satisfactory surgical results by decreasing early complications related to excessive filtration and by ensuring a controlled intraocular pressure.[9-12]

The aim of our study was to evaluate the results, complications, effectiveness and reliability of combined PT surgery and laser suture lysis (LSL) in the early postoperative period.

MATERIALS AND METHODS

This study was conducted at the Ankara Education and Research Hospital ophthalmology clinic glaucoma unit. The study was approved with decision number 0498 at the meeting with the date and number of 06.06.2018-48 by the ethics committee of the hospital and was conducted in accordance with the principles of the Helsinki Declaration. The files of 33 patients who underwent combined PT surgery with the same method and by the same ophthalmic surgeon (ÜE) between 2013 and 2018 were investigated by using the glaucoma unit's archive in this retrospective study. The age, gender, and the operated eye were recorded. Preoperative and postoperative best corrected visual acuity (BCVA), number of glaucoma drugs used, and intraocular pressure (IOP) measurements were compared. Visual acuities were measured using the Snellen chart followed by conversion to the LogMAR chart, and statistical comparisons were made accordingly. In addition, surgical complications, the need for early postoperative LSL, IOP changes after LSL, and complications after LSL were investigated.

The iridocorneal angle evaluation was conducted according to the criteria defined by Shaffer as follows: grade 0, a closed angle without visible angle structures; grade 1, a very narrow angle with Schwalbe's line visible only; grade 2, a moderately narrow angle with Schwalbe's line and trabecular meshwork visible; grade 3, an open angle with trabecular meshwork and scleral spur visible; grade 4, the widest angle with the ciliary body band visible.[13]

All our cases underwent primary glaucoma surgery, including the uveitic glaucoma and angle closure glaucoma cases. Patients with a history of glaucoma surgery were excluded from the study.

Inclusion Criteria

We included adult patients who had undergone combined phacotrabeculectomy surgery due to glaucoma together with cataract decreasing the visual acuity to below 0.2 in this study.

Exclusion Criteria

The exclusion criteria were determined as neovascular glaucoma, pediatric glaucoma, traumatic cataract and glaucoma, juvenile glaucoma, history of ocular trauma or intraocular surgery, less than 6 months of postoperative follow-up, and missing records in the patient chart.

Surgical technique

Apart from a small number of cases where general anesthesia was used, the anesthesia was generally provided with a subtenon injection. A fornix-based conjunctival flap was prepared. Following cauterization, 0.2 mg/ml of Mitomycin C was applied for 3 minutes with an impregnated sponge and the area then washed with balanced salt solution. A scleral flap 4x4 mm in size and 50% in thickness was prepared. The PHACO part of the procedure was then started. A clear corneal incision was made and viscoelastic administered into the anterior chamber. This was followed by the creation of 2 paracenteses. Capsulorhexis and hydrodissection were performed. A groove was created and the nucleus divided. PHACO was performed with the stop and chop technique and any remaining cortex removed with irrigation-aspiration. The intraocular lens was then placed into the sac. The trabeculectomy procedure was then continued and a trabeculectomy 2x1 mm in size was created under the scleral flap. Iridectomy was performed next and the scleral flap was closed with four 10/0 nylon sutures. This was followed by conjunctiva closure with a 10/0 nylon suture and the removal of any remaining viscoelastic from the anterior chamber. Cefuroxime at a dose of 1 mg/0.1 ml was administered into the anterior chamber. The process was concluded with a subconjunctival injection of gentamicin and dexamethasone.

Laser Suture Lysis Technique

Our criteria for LSL were a flat bleb, inadequate filtration due to tight wound closure, intraocular pressure over

21 mmHg before ocular massage, the lack of a shallow anterior chamber despite high intraocular pressure, and the development of a bleb with ocular massage.

LSL was performed with the argon blue-green laser (Visulas 532s, Carl Zeiss Meditec AG, Jena, Germany) under topical anesthesia. Scleral flap sutures were cut using a laser spot size of 50-100 microns, duration of 100 ms, and power of 600-800 mW. The Hoskins lens (Ocular instruments, Inc., Bellevue, WA, USA) was used to make the sutures visible by compressing and whitening the conjunctiva during the suture cutting procedure

Statistical Analyses

Frequency and percentage values were provided for categorical variables and the mean, standard deviation, median, minimum and maximum values were provided for continuous variables. Normal distribution of continuous variables was investigated with the Shapiro-Wilk Lambda test. Chi-square analysis was used for the correlation between categorical variables. When appropriate, categorical variables were evaluated with the Fisher-Freeman-Halton Test. Correlation between dependent variables were evaluated with Wilcoxon's sign-rank test and the Friedman test. Bonferroni-corrected Dunn Multiple Comparisons were used for paired comparisons. A p level <0.05 was accepted as significant for all analyses. The analyses were evaluated with the NCSS 11 (Number Cruncher Statistical System, 2017 Statistical Software) Program (NCSS 11 Statistical Software (2017). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/ncss).

RESULTS

The 30 patients consisted of 18 (60%) males and 12 (40%) females with a mean age of 68.64±9.27 (40-86) years. Pseudoexfoliative glaucoma (PEG) and primary open angle glaucoma (POAG) were the most common types of preoperative glaucoma with 14 and 12 eyes, respectively, in addition to 3 eyes with glaucoma secondary to uveitis, 2 eyes with primary closed angle glaucoma (PCAG), 1 eye with glaucoma after penetrating keratoplasty (PKP), and 1 eye with pigmentary glaucoma and concomitant cataract

Table 1. *Demographic Characteristics of the Patients.*

Gender (%)	n=30
Male	18 (60%)
Female	12 (40%)
Age (Mean ±SD)	68.64±9.27
Glaucoma Type (%)	n=33
POAG	14 (42%)
PEG	12 (36%)
UG	3 (9%)
PCAG	2 (6%)
PKP Glaucoma	1 (3%)
PG	1 (3%)

POAG: primary open angle glaucoma, **PEG:** pseudoexfoliative glaucoma, **UG:** uveitic glaucoma, **PCAG:** primary closed angle glaucoma, **PKP Glaucoma:** glaucoma after penetrating keratoplasty, **PG:** pigmentary glaucoma

(Table 1). Postoperative BCVA was significantly better (p<0.0001) than the preoperative value. Mean preoperative BCVA was 1.21±0.49 and mean postoperative BCVA was 0.45±0.51 with the LogMar chart (p<0.0001). IOP was significantly low at the 1st day, 1st week, 1st month and 1st year postoperative follow-up (p<0.0001) (Table 2). The postoperative antiglaucomatous drug requirement was significantly lower (p<0.0001) with a mean value of 2.91±0.68 drugs preoperatively and 0.64±1.06 postoperatively (p<0.0001). Postoperative LSL was required once in 12 eyes and twice in 4 eyes. The mean time to LSL was 6.75±4.95 days for the first procedure and 15.5±3.87 days for the cases requiring a second procedure. The mean IOP value was 26.75±5.4 mmHg preoperatively and 11.31±2.96 mmHg postoperatively in the eyes that had undergone LSL (p<0.0001) (Table 3). PT-related complications included postoperative leakage in 5 eyes with 2 of them requiring suture revision. A total of 4 eyes had shallow choroidal detachment that regressed with medical treatment and 2 eyes had hyphema that showed spontaneous regression in the postoperative period. Cystic bleb formation was observed in 1 eye and IOP control was possible only with the help of an antiglaucomatous drug in this case. We did not encounter any LSL complications that threatened vision or affected surgical success. Hypotonia

Table 2. *Preoperative and postoperative intraocular pressure change.*

Preoperative IOP	Postoperative 1st Day IOP	Postoperative 1st Week IOP	Postoperative 1st Month IOP	Postoperative 3rd Month IOP	Postoperative 1st Year IOP	P Value
(n=33) 30.42±8.74	(n=33) 14.58±8.03	(n=33) 15.97±5.16	(n=33) 15.45±4.95	(n=33) 15.45±7.04	(n=33) 13.85±2.35	p<0.0001
Friedman Test						

Table 3. *Laser Suture Lysis.*	
Pre-LSL IOP (mean±SD)	26.75±5.4
Post-LSL IOP (mean±SD)	11.31±2.96
Mean LSL timing (day)	
1st LSL (n=16)	6.75±4.95
2nd LSL (n=4)	15.5±3.87
LSL: laser suture lysis, **IOP:** intraocular pressure	

developed in two patients and mild choroidal detachment that regressed spontaneously within a short time in 1 patient.

DISCUSSION

Combining PHACO and trabeculectomy has become much more common due to the advances in cataract surgery and the advantage of a small incision. Trabeculectomy for glaucoma and PHACO for cataract remain the respective gold standards in surgical treatment. Age is a risk factor for both of these disorders and the elderly population is gradually increasing globally, leading to an increase in the coexistence of glaucoma and cataract. In this study, the combined surgery was successful in terms of IOP control, visual rehabilitation and postoperative glaucoma drug requirement and the complications were consistent with the literature. IOP control was achieved in all cases, without any medication in 25 (76%) eyes and with medication in 8 (24%) eyes.

We had 3 patients where PT was performed for glaucoma and cataract secondary to uveitis. Postoperative complications can be more common in these patients due to the difficulty of inflammation control. We observed a cystic bleb in one of our patients and fibrotic scarring on the bleb in another patient. IOP control was possible with medication in both of these patients. However, IOP control could be ensured without medication in only one of the uveitic patients. The visual acuity increased postoperatively in two eyes but remained the same in one eye. Another study reported the general success rate of PT with mitomycin C to be 77% in uveitic eyes with cataract and glaucoma and the technique was found to benefit uveitic patients. The authors recommended long-term follow-up and strict control of inflammation in this patient group.[14]

PCAG was present in two of the 33 eyes evaluated in our study. No postoperative complications were experienced in these two eyes and visual improvement and IOP control were achieved in both patients. IOP control was possible in one patient without medication but the other patient required medication. Chan et al. compared the cost effectiveness of PHACO and combined PT to reduce IOP in patients with PCAG and cataracts.[15] The cost was calculated by considering preoperative evaluation costs, surgical interventions, additional procedures for treatment, filtration complications and related care, and the postoperative follow-up and drug costs in this study. Combined PT was found to be a lower cost option for lowering IOP in eyes with PCAG and cataract over a 2-year follow-up period. Another study has also reported combined surgery to be more successful in terms of IOP control and number of glaucoma drugs where combined PT and PHACO were compared in eyes with chronic angle-closure glaucoma (CACG) and cataract. However, the rate of postoperative complications was higher with combined surgery.[16] Angle-closure glaucoma is more common in Asian countries[17] and these publications are usually from these countries.

One eye was re-operated due to secondary glaucoma after PKP in our study. The remaining 27 eyes had open-angle glaucoma and 14 were diagnosed with PEG, 12 with POAG, and 1 with pigmentary glaucoma. IOP control was achieved in all of these patients. Satisfactory visual improvement was also present except in two patients.

There are many studies on combined PT in the literature. One study reported that PT was performed without an antimetabolite in PEG and POAG and the three-year follow-up results indicated that the procedure was safe and effective with good IOP control.[18] Choy compared the results of trabeculectomy and PT in glaucoma patients from China and reported that PT was better as regards visual results while both procedures were similarly successful in terms of IOP control.[19]

Tan et al. found the incidence of complications in the first postoperative year and the re-operation rates to be similar between PT and trabeculectomy with an antimetabolite in a large series consisting of 816 POAG and 446 PCAG patients.[20] The long-term postoperative refractive results of PT and PHACO in patients with open-angle glaucoma were compared by Chung et al., and the long term refractive results of PT were found to be similar to PHACO regardless of the preoperative axial length.[21] No significant difference was found between PHACO and PT in terms of long-term posterior capsular opacification in another study.[22] Mitomycin C and post-PT hypotonia, hyphema and shallow anterior chamber were the most common postoperative complications in 105 POAG and 55 PCAG patients in a study evaluating the complications. Most complications were temporary and self-limiting with early period complications in 73 patients (31 hypotonia, 16 hyphema, 13 shallow anterior chamber, 5 bleb leak cases

among others) and late period complications in 13 patients (5 hypotonia, 2 shallow anterior chamber, and 2 blebitis cases among others).[23] Our complications were temporary and self-limiting.

Our rate of postoperative hypotonia was lower than reported in the literature. We leave the scleral flap sutures relatively tight to avoid postoperative hypotonia and perform planned LSL during postoperative follow-up. We aim to minimize early complications due to excessive filtration by providing a controlled IOP in this manner. LSL was performed in 16 of the 33 eyes in this study.

LSL is an effective tool to provide controlled IOP decrease with an acceptable safety profile in the early postoperative period.[11,12,24,25] Suture lysis can be performed until fibrosis develops in the scleral flap. Although effective LSL can be performed until the postoperative 4th week in eyes where an antimetabolite is used, the most effective period is 2-3 weeks after surgery. Şatana et al. reported the mean LSL duration after Mitomycin C trabeculectomy to be 18.5 days in their study.[11] The mean duration between trabeculectomy and LSL was found to be 7.9 days in the study of Bayraktar et al.[12] In our study, the mean duration was 6.75 days for first LSL and 15.5 days for the second LSL.

Another advantage of the combined approach is the lower risk of early IOP elevation. The combined approach is useful for early-stage IOP elevation, which creates a risk especially in advanced glaucoma cases where optic nerve damage is evident.[26]

Study Limitations

The limitation of our study is that we did not have a homogeneous group in terms of glaucoma type.

CONCLUSION

In conclusion, in addition to its cost and time advantages, combined PT surgery is an effective and reliable surgical method in glaucoma and cataract coexistence. Suture lysis with argon laser is an effective and reliable method in the early period to achieve target intraocular pressure after phacotrabeculectomy and can be performed multiple times.

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