Outcomes of Gonioscopy - assisted Transluminal Trabeculotomy in Eyes with prior Glaucoma Surgery

Aim : To report outcomes of Gonioscopy - assisted Transluminal Trabeculotomy (GATT) in eyes with prior failed glaucoma surgery
Material & Methods : This retrospective review included 30 eyes of 30 patients who underwent GATT in eyes with failed prior glaucoma surgeries. Success was complete when intraocular pressure (IOP) was between 6-21 mmHg without antiglaucoma medications (AGM) and qualified with or without AGM.
Results : 21 eyes underwent GATT and 9 eyes underwent Phaco-GATT. Post-surgery, mean IOP decreased from 27.1 to 16.1 mmHg with a mean drop in AGM from 4.9 to1.6 (both p<0.0001). At a mean follow up of 10.1 months, 7 eyes (23%) had complete success, 28 eyes (93.3%) had qualified success and 2 eyes (6.6%) failed. The common complication noted was hyphema in 14 eyes (46.6%) which resolved in 1 week.
Conclusions : GATT seems to be effective and safe surgical alternative to control IOP in eyes with prior failed glaucoma surgeries

Introduction

Glaucoma is second leading cause of irreversible blindness in the world.[1] The initial management would be medical therapy, when IOP is uncontrolled guarded filtration procedure like trabeculectomy or glaucoma drainage implant are helpful to control the intraocular pressure (IOP). Apart from the bleb related complications that may occur, one of the major long term problems of trabeculectomy is failure due to subconjunctival fibrosis and or episcleral fibrosis.[2]

When the primary trabeculectomy fails the treatment options are bleb needling,[3] canaloplasty,[4] revision of the previous trabeculectomy site,[5] repeat trabeculectomy,[6] glaucoma drainage implant,[6] or laser cyclophotocoagulation. With the better understanding and newer surgical options that are angle based, several ab-interno and ab-externo procedures like kahook dual blade(KDB),[7] Omini/ Iscience catheter trabeculotomy,[8] iStent inject,[9] Xen gel stent,[10] Trabectome,[11] and PreserFlo Microshunt[12] have been described. Availability and affordability is a challenge with several of these devices. Less expensive options options for angle based surgery in eyes with open angle glaucoma are Bent angle needle goniotomy (BANG),[13] and Gonioscopy assisted transluminal trabeculotomy (GATT).[14] The GATT procedure popularised by Grover et al in 2014 is ab-interno under direct gonioscopic assistance using a 5- prolene suture to canulate the schelmms canal and create a 360 degree ab-interno trabeculotomy.

Grover et al [15] reported promising results with GATT in eyes with previous failed glaucoma incisional surgeries like trabeculectomy, glaucoma drainage device, trabectome and endocyclophotocoagulation. The study reported 40% reduction in preoperative IOP and 25.6% reduction in antiglaucoma medications at the end of 24 months.

Scarring of trabeculectomy blebs and failed implants are a huge problem in our population as well and several surgeons are opting for angle based procedures in them. However, the outcomes of angle based surgeries in eyes with failed filtering procedures are not published in Indian population. In the current study we report the outcomes of GATT in eyes with open angles glaucoma with failed previous glaucoma surgeries.

Methods

In this consecutive retrospective series, we included all eyes that underwent Gonioscopy assisted transluminal trabeculotomy (GATT) procedure following failed trabeculectomy or tube surgery/surgeries at LV Prasad Eye Institute between January 2021 to April 2023. The study followed the tenants of the Declaration of Helsinki and was approved by the institutional review board. The data noted from the database were best-corrected visual acuity (BCVA), diagnosis, preoperative IOP, number of medications,

number and type of glaucoma surgeries performed previously, intraoperative details including the degree of angle incised, intraoperative complications/ problems, need for additional procedures, postoperative BCVA, IOP at various time points, number of antiglaucoma medications and complications if any.

The GATT was chosen as a surgical procedure in eyes with open angles on preoperative gonioscopy. i.e. visible pigmented trabecular meshwork. The location of the ostium and whether the osteum was involving the trabecular meshwork or not and tube position were also noted. Patients with failed prior glaucoma incisional surgeries with either primary or secondary open angle glaucoma were included. The patients in whom angles were closed and extensive peripheral anterior synechiae were excluded. If these eyes had significant cataract then a combined phacoemulsification was performed along with GATT.

Surgical procedure

The surgical technique was similar for all patients although performed by 3 surgeons. When GATT was combined with cataract surgery, often cataract surgery was performed first followed by GATT, the order was reversed in a few cases. Briefly, after positioning of the patient with head tilted away from the surgeon and the microscope was tilted to 35 degree away from the surgeon as well. The surgeon was seated temporally. Through a 20 G paracentesis, Sodium hyaluronate 1.4%w/v was injected and posterior trabecular meshwork (PTM) was identified. Goniotomy incision was made in the upper margin of PTM for 1-2 clock hours in the nasal angle under direct visualization of the angle through a Swan Jacob lens. A 5–0 prolene suture with blunted umbrella tip was passed through a tangential paracentesis and was grasped by a toothed serrated 23 G Grishabers' forceps and the Schlemm's canal (SC) was threaded through the ab-interno goniotomy incision. The suture, once confirmed to be in the SC under direct visualization, was advanced until the leading umbrella tip was visualized at the other end of the goniotomy incision. The leading tip was held with the forceps, while the other end is pulled to strip off the trabecular meshwork circumferentially. Viscoelastic was washed leaving behind 20-30% to tamponade the eye to prevent blood reflux from opened Schlemm's canal. The postoperative follow-up schedule was typically at 1 day, 1 week, 1 month, and 3 monthly thereafter, interim visits were unplanned as and when needed if there were any problem's or complications based on the need. The post operative regime included topical antibiotic for 1 week, topical non-steroidal anti-inflammatory for 5-6 weeks and tapering doses of topical steroids for 1-4 weeks. The IOP spikes were treated with systemic acetazolamide and topical anti-glaucoma medications. The initiation or continuation of AGM was based on the IOP and amount of disc damage.

Success Criteria

Complete success was defined as IOP >5 and ≤ 21mm Hg with no glaucoma medications. Qualified success was defined as IOP≤21 mm Hg with or without anti- glaucoma medications. Failure was defined as IOP > 21mm Hg (despite maximum medication) or < 5 mm Hg, or if additional glaucoma surgery was required for IOP control.

Statistical analysis

The statistical analysis was performed using STATA v11.0 (Stata Corp, College Station, TX, USA). The normality of continuous data was assessed using the Shapiro-Wilk test. Descriptive statistics included mean and standard deviation (SD) for normally distributed variables and median and inter-quartile range (IQR) for non-normally distributed variables. Categorical data were described in proportions (with 95% confidence intervals). The probability of success was evaluated using Kaplan-Meier survival analysis. A $P \leq 0.05$ was considered statistically significant.

Results

Thirty eyes of 30 patients were included in the analysis with a mean (SD) age of 51.8 ±16.1 years. Among the 30 eyes, 21 eyes underwent GATT and remaining 9 eyes underwent Phaco-GATT. Of the 30 eyes, 24 eyes had prior trabeculectomy that failed, 3 eyes had prior Phaco-trabeculectomy that failed and

3 eyes had a prior glaucoma drainage device that failed. Number of prior glaucoma interventions was one in 23 eyes (76.6%), two in 6 eyes (20%) and three in 1 eye (16.6%).

360 degree trabeculotomy was achieved in 20 eyes (66.7%), 5 eyes (16.7%) had 270 degree trabeculotomy and 5 eyes (16.7%) had 180 degrees trabeculotomy.

Table 1 Shows the demographic and clinical features of the study cohort.

Number of eyes	30
Mean age (SD)	51.8 ±16.1
Male: Female	27:3 (90%, 10%)
Right eye: Left eye	17:13
Diagnosis [n (%)]	
1. POAG	13 (43.3)
2. JOAG	10 (30)
3. PXG	2 (6.7)
4. PACG	2 (6.7)
5. Angle recession	2 (6.7)
6. Glaucoma in Pseudophakia	1 (3.3)

The mean preoperative IOP (SD)was 27.1(±7)mmHg and mean antiglaucoma medications were 4.9(±1). Mean postoperative IOP at last follow up was 16 (±3.8) mmHg and mean number of antiglaucoma medications were 1.6 (both decreased significantly with $p<0.0001$).

At a mean follow up of 10.1months, 7 eyes (23%) had complete success, 28 eyes (93.3%) had qualified success and 2 eyes (6.6%) failed. The 2 eyes which failed needed glaucoma valve drainage device for IOP control.

Postoperatively mean usage of topical steroids was 21 days(± 16) and steroid response was noted in 5 eyes in which 3 eyes had IOP raise in the same eye and 2 eyes had IOP raise in the contralateral eye. The IOP spikes post operatively within 1 month were noted in 6 eyes in which 4 eyes had spike on postoperative day 1 and 2 eyes at 1 week postoperatively which were controlled eventually. The most common complication noted was hyphema in 14 eyes(46.7%), 4(28.5%) eyes had dispersed / microhyphema (less than 1 mm) and 10 (71.4%) eyes had macrohyphema (>1mm). Majority of them (12 eyes, 85.7%) resolved within 1 week. None had any serious complication needing intervention.

Discussion

In our study including 30 eyes with open angles and prior failed glaucoma surgeries that underwent GATT. At the end of mean follow up of 10 months, there was statistically and clinically significant mean IOP reduction of 11 mmHg along with a mean reduction of 3.3 glaucoma medications. This indicates that GATT was effective in lowering IOP and reducing the need for glaucoma medications in these eyes. It is noteworthy that 80% (24 eyes) of the eyes included in the study had advanced disease and required a target IOP in the lower teens.

Lowering of IOP after angle based procedure has been reported in failed glaucoma surgery eyes. Bussel et al[11] studied the outcomes of ab interno trabeculotomy with trabectome in post failed trabeculectomy patients , Mosaed and colleagues[16] described the outcomes of ab interno trabeculotomy with trabectome in failed implant eyes. These studies reported mean IOP decreases between 7 and 8 mm Hg with a 0.8 decrease in medications respectively. Only a part of inner wall of schlemns canal is excised with the trabectome, however, there is a circumferential opening of SC in GATT, that could possibly explain the greater efficacy of GATT.

Similarly Karimi et al[10] studied efficacy of Ab-interno Xen Gel Stent after failed trabeculectomy with mean reduction of 7.9 mmHg and Quaranta et al[12] studied efficacy of Preserflo in eyes with failed trabeculectomy showed IOP reduction of 12 mmHg similar to our results. But this being a ab-externo conjunctival procedure, cannot be compared with GATT. Grover et al [15] also had similar IOP reduction with GATT in patients after failed glaucoma surgery but reduction of medications was only 1.1 when compared to our study. This difference in the number of medications might be due to patients in our study had advanced glaucoma who were on higher preoperative antiglaucoma medications. Therefore GATT surgery resulted in significant reduction in number of medications.

Johnson and Matsumoto[17] have reported that the SC size is decreased post filtering surgery and majority of aqueous flows through the osteum and drains subconjunctivally. However, we did not encounter any difficulty in cannulating the suture in the SC.

There were no serious complications observed with GATT in the study. The only postoperative complication noted was hyphema in 14 eyes (46.7%), out of which 4 eyes had dispersed / microhyphema and 10 (71.4%) eyes had macrohyphema. This could be due to reflux of blood from the Schlemm's canal into anterior chamber. Hyphema in majority of these eyes 12 eyes (85.7%) resolved within 1 week with topical steroid medications and the other 2 eyes resolved in 2 weeks. Grover et al[15] also reported that 34 % and 14% of eyes have hyphema at one week and one month post operative period respectively.

Limitation of our study are retrospective nature of the study which has inherent limitations, such as the reliance on existing data and potential for selection bias. Additionally, the limited follow-up period may not provide a comprehensive understanding of long-term outcomes and potential complications. The lack of blinding in the study is another important limitation. Non-blinded assessments can introduce bias, consciously or unconsciously, in the evaluation and interpretation of results.

GATT is effective and safe procedure in patients with uncontrolled IOP after glaucoma filtering surgery, especially those who are having high tendency for scaring or those where conjunctival procedures are not possible or have high risk of complications. This procedure helped in reducing the intraocular pressures by 40 % and the number of anti-glaucoma medications by 67%. So this can be considered as a viable treatment option in eyes with prior failed glaucoma surgeries like trabeculectomy or implants.

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