Surgical Management of Glaucoma: Newer Concept

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Abstract

Purpose: Comparative study of combined Viscocanalostomy-trabeculectomy (VISCO-TRAB) with mitomycin C (MMC) to Trabeculectomy (TRAB) with mitomycin C for management of primary open angle glaucoma (POAG).

Methods: The study comprised of 25 subjects with bilateral POAG who underwent VISCO-TRAB + MMC surgery in one eye and TRAB + MMC in fellow eye. VISCO-TRAB constituted lamellar scleral flap, deep scleral flap, deroofing of schlemm’s canal (SC), viscodilation of SC, penetrating trabeculectomy, peripheral iridectomy and tight flap closure. Success criteria included intraocular pressure (IOP) < 14 mmHg and complications if any. P value of less than 0.05 was considered statistically significant.

Results: Mean IOP was significantly lower after VISCO-TRAB compared to TRAB at 1 week and 3 months post operatively (P<0.001). Target IOP was achieved in 96% in VISCO-TRAB group compared to 84% in TRAB group.

Conclusion: Combined VISCO-TRAB is effective in reducing IOP to the target level for advanced glaucoma with lower postoperative complications.

Keywords: trabeculectomy, viscocanalostomy, combined viscocanalostomy-trabeculectomy

Introduction

The concepts of glaucoma have evolved in the past 100 years, and still remain imprecise and subject to technical qualifications and thus glaucoma is known as the silent thief of sight. For decades, the popular option considered as the first surgical approach to lowering significantly high intraocular pressure (IOP) remains trabeculectomy. But, over the last few years, numerous techniques have been introduced as alternative to conventional trabeculectomy.

Viscocanalostomy-Trabeculectomy

The technique of combined viscocanalostomy-trabeculectomy (VISCO-TRAB) comprises dissection of a deep scleral flap, viscodilation of the schlemm’s canal (SC), and intended macroperforation (penetrating sclerokeratectomy). This is modified by enhancing internal flow via the SC and a scleral lake and limiting the external filtration with tight suturing of the scleral flap in order to control hypotony. Combined VISCO-TRAB can be performed for all types of glaucoma regardless of the appearance of the angle. Disadvantages of this technique are that it requires a learning curve for surgeons not familiar with non-penetrating glaucoma surgery, consumes more time than routine trabeculectomy, and there is the extra expense of a viscoelastic and a special knife and cannula not routinely used in trabeculectomy.

Combined VISCO-TRAB has been found to be efficacious in reducing IOP to a maximally low target level during the early postoperative period in a previous study. Safety was indicated by the reduction of the postoperative pressure spikes and the devastating complications related to excessive external filtration.

Materials and Methods

This prospective, randomised, comparative, interventional study was conducted on the patients admitted in the Upgraded Department of Ophthalmology, SMS Medical College and Hospital, Jaipur. Before commencing the study, each patient was acquainted with the investigative nature of the study, the advantages and potential risks. The surgical technique and its visual prognosis was properly explained, and an informed consent was taken. All patients were admitted to the hospital at least one day before surgery for routine preoperative investigations.

A total of 25 patients of bilateral primary open angle glaucoma (POAG) (50 eyes) were included in the study and randomly divided into two groups:

Group A: Combined Viscocanalostomy- Trabeculectomy surgery with Mitomycin C in one eye.

Group B: Trabeculectomy surgery with Mitomycin C in the other eye

Patients aged over 40 years, with an IOP >20 mm Hg on maximal tolerated anti-glaucoma treatment, patients not tolerating medical treatment or showing poor compliance for medical treatment, those who could not afford anti-glaucoma medicines, and patients willing for surgery and follow up, were included in this study. Patients with angle closure glaucoma, neovascular glaucoma, low tension glaucoma, congenital and secondary glaucoma, active ocular infection and inflammatory disorders, any corneal pathology preventing reliable applanation tonometry and patients not willing for surgery were excluded from the study. All enrolled patients underwent full ophthalmological and systemic evaluation including visual assessment, tonometry, fundoscopy and gonioscopy. Patient data was recorded and analysed. Student T test was used for analysis of quantitative data while chi-square test was used for qualitative data. P < 0.05 was taken to be statistically significant.
Surgical Technique

Group A: VISCO-TRAB + MMC
A conventional superior rectus suture was placed and a fornix based conjunctival flap was prepared. Haemostasis was achieved by adequate wet field cautery. (Figure 1) Subconjunctival Mitomycin C 0.2 mg/ml was applied for 3 minutes. (Figure 2) A 4 x 4 mm rectangular scleral flap, of one-third thickness was dissected to within 1 mm of clear cornea with a disposable crescent knife. (Figure 3) A second deeper rectangular flap was dissected 0.5 mm inside the border of the first flap, leaving a thin layer of sclera. (Figure 4) The dissection was carried further into clear cornea for about 2 mm. Schlemm’s canal was identified and deroofed (Figure 5). Sodium hyaluronate 1.4% was injected into the right and left ostia of the schlemm’s canal using a modified cannula mounted on an insulin syringe. (Figure 6) The floor of schlemm’s canal was incised and a trabeculocorneal segment was excised (measuring 1.5 mm long and 3 mm wide). Inner flap was excised and peripheral iridectomy was performed. The outer scleral flap was closed with 2 water tight 10-0 nylon sutures. Balanced salt solution was used for anterior chamber formation and two wing sutures were applied at dissecting edge to close the conjunctiva. Subconjunctival injection of 0.3 ml Gentamycin and 0.3 ml Dexamethasone was given on completing the procedure.

Group B: Trabeculectomy + MMC
After putting a conventional superior rectus bridle suture and preparing a fornix based conjunctival flap, subconjunctival Mitomycin C 0.2 mg/ml applied for 3 minutes. A 4 x 4 mm rectangular scleral flap one third of the thickness was dissected to within 1 mm of clear cornea.
with a bard-parker knife. After creating a paracentesis opening, inner sclerostomy block was dissected out with the blade (2 × 3 mm) at the base of the hinge of the superficial scleral flap. Peripheral iridectomy was performed through the inner sclerostomy with a vanna’s scissors and a single toothed fine forceps. Scleral flap was reapproximated with two 10-0 nylon sutures. Conjunctival flap was closed watertightly by interrupted 10-0 nylon sutures. A subconjunctival injection of 0.3 ml Gentamycin and 0.3 ml Dexamethasone was given on completing the procedure.

A combination of antibiotic-steroid [Tobramycin 0.3% + Dexamethasone 0.1%] eye drops every 2 hours for one week and tapered over 5 weeks was given postoperatively, to all patients. Cycloplegic- mydriatic [Homatropine 2%] eye drops were used if shallow anterior chamber, hypotony or any signs of early inflammation were present. The number, frequency and duration of the anti-glaucoma drugs, if required, was carefully noted and compared in the above two groups. Digital massage and focal compression were performed depending on the IOP level and the degree of filtration.

Postoperatively, all subjects were examined at day 1 and 7, then at 1 month, 2 months and 3 months for intraocular pressure, unaided visual acuity and best corrected visual acuity. Slit lamp examination was done at every visit to evaluate the condition of the filtering bleb, anterior chamber depth, inflammation and bleb scoring. Fundoscopy was done for any change in cup disc ratio postoperatively or cystoid macular oedema. An IOP of 14 mmHg was taken as success as none of the cases selected in this study were of advanced glaucoma.

Results
Surgical success was defined in terms of IOP measurement for 3 months according to the following criteria:

1. Complete success – final IOP < 14 mm of Hg without medication.
2. Qualified success – final IOP < 14 mm of Hg with single drug
3. Failure – IOP > 14 mm of Hg with medications

The results of surgical success rate, the preoperative and postoperative IOP comparison, demographic pattern of patients and complications are presented in (Table 1-4) respectively.

### Table 1: Demographic pattern of patients

| Age Group in Years | Male | Female |
|-------------------|------|--------|
| 40-49             | 1    | 3      |
| 50-59             | 3    | 2      |
| 60-69             | 5    | 3      |
| 70 and above      | 5    | 3      |
| Total             | 14   | 11     |

### Table 2: Success rate defined by pressure control at 3 months

| Age Group in Years | VISCO-TRAB (n=25) | TRAB (n=25) |
|--------------------|-------------------|-------------|
| Complete success (IOP < 14 mm Hg without medication) | 24 (96%) | 21 (84%) |
| Qualified success (IOP < 14 mm Hg with medication) | 01 (4%) | 02 (8%) |
| Failure (IOP > 14 mm Hg with medication) | 00 | 02 (8%) |

### Table 3: Mean IOP (in mmHg) preoperatively and on postoperative 3 month follow up (Group A- Visco-trab, Group B- Trab)

| Parameter | Group | N | Mean (mmHg) | Std. Deviation | % of IOP reduction | 'p' Value |
|-----------|-------|---|-------------|----------------|---------------------|-----------|
| Pre op IOP | A     | 25 | 24.48       | 3.97           | 0                   | 0.510     |
|           | B     | 25 | 25.20       | 3.70           | 0                   |           |
| Post op IOP | A     | 25 | 10.36       | 1.89           | 57.68               | <0.001    |
| Day-1     | B     | 25 | 12.40       | 1.61           | 50.79               |           |
| Post op IOP | A     | 25 | 11.16       | 2.15           | 54.41               | 0.149     |
| Day-7     | B     | 25 | 12.20       | 2.81           | 51.58               |           |
| Post op IOP | A     | 25 | 11.80       | 1.58           | 51.79               | <0.001    |
| 1 Month   | B     | 25 | 13.96       | 1.54           | 44.60               |           |
| Post op IOP | A     | 25 | 11.56       | 1.45           | 52.77               | <0.001    |
| 2 Month   | B     | 25 | 14.96       | 1.49           | 40.63               |           |
| Post op IOP | A     | 25 | 11.16       | 1.37           | 54.41               | <0.001    |
| 3 Month   | B     | 25 |             |                |                     |           |

### Table 4: Postoperative complications

| Post operative complication | Group A | Group B |
|-----------------------------|---------|---------|
| Early                       | 2       | 2       |
| Late                        | -       | 3       |
| Total                       | 2       | 5       |

Discussion
The basic principle of treatment in a case of glaucoma is to prevent loss of visual function and to achieve the best quality of life for the patient. In VISCO-TRAB, early postoperative IOP reduction is partly attributed to improved internal flow mechanism (dilatation of schlemm’s canal and scleral lake formation) and partly due to some external filtration. The study was conducted to compare the efficacy and
complications of VISCO-TRAB with MMC and TRAB with MMC for the management of primary open angle glaucoma. Fifty (50) eyes of twenty five (25) patients of primary open angle glaucoma were included in the study and divided into 2 equal groups. Eyes in group A underwent VISCO-TRAB with MMC and that in group B underwent conventional standard TRAB with MMC. All the surgeries were performed by a single surgeon to minimize the variability in the results of surgery due to surgeon factor. Postoperative follow-up in both groups was of 3 months. Of the total twenty five cases included in study, 14 were males and 11 were females (M: F ratio = 1.27: 1). The mean age was 61.48 yrs. Most of the patients were in the age group of 60-69 years (32%) or >70 years (32%). The mean number of medications used preoperatively was the same (2.44±0.65) in both groups, which were similar to the study of Eid et al1,2 (2.7±1.2 in Visco-Trab and 2.8±1.2 in Trab). The mean number of anti-glaucoma medications used postoperatively in group A was 0.04±0.19 and in group B was 0.16±0.37 (P= 0.046). In both groups, there was a significant reduction in the mean number of medications required postoperatively. The mean preoperative IOP in group A was 24.48±3.97 mmHg and in the group B was 25.20±3.70 mmHg. Mean IOP was slightly higher in Group B but the mean IOP in two groups were not statically significant preoperatively (P= 0.510). The mean preoperative logMAR best corrected visual acuity (BCVA) in group A was 0.88 ± 0.17 and in the group B was 0.84±0.18 while postoperative BCVA was reduced to 0.66±0.25 and 0.70±0.22 respectively, though not significantly (P=0.05). Both VISCO-TRAB with MMC and TRAB with MMC were comparable in terms of IOP reduction on first postoperative day. Early postoperative IOP reduction after VISCO-TRAB was partly attributed to improved internal flow mechanisms and partly to external filtration. The mean postoperative IOP on day 1 was 10.36±1.89 mm Hg in group A and 12.40±1.61 mm Hg in group B (P < 0.001), a reduction of IOP by 57.68 % in group A and by 50.79 % in group B. Reduction in mean IOP was seen both in group A and group B at 1 month (11.80 mmHg and 13.96 mmHg respectively; P < 0.001), 2 months (11.56 mmHg and 14.96 mmHg; P < 0.001) and at 3 months (11.16 mmHg and 13.92 mmHg; P < 0.001). Mean IOP reduction gradually reduced over time, more so in group A. These findings were similar to the study done by Eid et al1 who found 52.5% reduced IOP in VISCO-TRAB group and 43.0% reduction in IOP in TRAB group (10.5±3.9 mm Hg v/s 13.6±5.0 mm Hg; P = 0.05) at third postoperative month. (Table 2) Both VISCO-TRAB and TRAB show good efficacy at reducing IOP in the early postoperative period. However, mean postoperative IOP increased in the later months in the TRAB group, suggesting a trend towards rising IOP over time. Filtering blebs were graded according to Migdal and Hitching.3 Postoperative bleb score on first day was 2.16±0.37 in VISCO-TRAB group and 2.04±0.20 in TRAB group; at three month, 4.17±0.48 in VISCO–TRAB group and 4.48±0.51 in TRAB group (P>0.05). An early postoperative complication seen in both group A and B was shallow anterior chamber, in one case in each group. Other complications like descemet’s detachment was also seen in one case in group A and choroidal effusion in one case in group B. Late postoperative complication in group B (TRAB) (lenticular changes) was seen in three cases (similar to the findings of O’Brart et al4). None of the cases in group A had any late postoperative complications. Complete success, defined as IOP < 14 mm Hg without medication, was observed in 96% in group A and 84% in group B in our study. Qualified success, defined as IOP < 14 mmHg with one medication, was seen in 4% in group A and 8% in group B. Failure, defined as IOP > 14 mmHg despite more than one medication was seen in two eyes (8%) in group B. This was similar to the findings of Eid and Tantawy4 who found a failure of two patients (11.1 %) in TRAB group.

Conclusion

This study found that although both VISCO-TRAB with MMC and TRAB with MMC significantly lower IOP in primary open angle glaucoma patients, VISCO-TRAB with MMC resulted in comparable IOP reduction with fewer complications. Though the results of our study have been encouraging, further studies on a larger group of patients are required for gaining more information and insight in the surgical management of primary open angle glaucoma.

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