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Original Research Article

Assessment of the Outcome in Patients with Glaucoma Treated with Trabeculectomy Done with and without the Use of Mitomycin C: A Comparative Study

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Abstract

Aim: The aim of the present study was to compare surgical outcome in patients with glaucoma treated with trabeculectomy done with and without the use of mitomycin C at a tertiary hospital.

Material & methods: This was a prospective, interventional, comparative study carried out, Regional Institute of Ophthalmology. Study duration was of 2 years. During study period total 50 patients were operated for glaucoma.

Results: 25 patients were each randomly assigned to trabeculectomy only and trabeculectomy with mitomycin C groups. General characteristics such as age, gender, laterality and glaucoma type were comparable in both groups. In both groups statistically significant reduction was noted for intraocular pressure (IOP) and IOP lowering medications post-operatively. Characteristics such as preoperative intraocular pressure (IOP), IOP at 6 month, IOP at 1-year last visit and number of IOP lowering preoperative medications were comparable in both groups. Trabeculectomy with mitomycin C did not required any IOP lowering medications at 6 month and 1 year. A statistically significant difference was noted for number of IOP lowering medications at 6 month and 1 year between two groups. Post-operatively failed trabeculectomy and iritis were common complications in both groups. Other complications were hyphema , hypotony and hypopyon.

Conclusion: Mean intraocular pressure (IOP) was reduced significantly at 12 months in trabeculectomy with MMC group compared to trabeculectomy without MMC. No significant difference was noted in complications from both groups.

Keywords: Glaucoma Surgery, Trabeculectomy, Trabeculectomy With Mitomycin C, Primary Open Angle Glaucoma.

Introduction

Glaucoma is a group of clinical symptoms or eye diseases that threaten and damage the optic nerve and its visual pathway, eventually resulting in visual impairment primarily caused by pathological intraocular pressure (IOP) elevation. Glaucoma treatment typically includes topical or systemic application of IOP-lowering drugs, laser therapy, and surgery. Trabeculectomy is still the primary method for treating glaucoma, with a success rate of only 70%–90% . [1] The procedure consists in creating a scleral flap and a full-thickness removal of trabecular tissue, to drain the aqueous humor from the anterior chamber to the subconjunctival space, forming a conjunctival filtering bleb. [2]

A common cause of trabeculectomy failure is the formation of a subconjunctival scar due to the wound-healing reaction. [3,4] With the introduction of adjunctive antimetabolites, such as 5-fluorouracil (5-FU) and mitomycin-C (MMC), which significantly decrease the post-operative subconjunctival scarring, have improved the long term success of trabeculectomy. [5,6,7] Mitomycin C (MMC) is commonly used to prevent cicatricial adhesion and enhance trabeculectomy success rates. [8,9] The concentrations of MMC used in trabeculectomy vary from 0.1 mg/mL to 0.4 mg/mL, depending on the surgeon. When high-concentration MMC is used, the effect of wound-healing inhibition is improved, but the possibility

of side effects such as postoperative hypotony, avascular bleb, bleb leak, and endophthalmitis is increased. [10,11,12]

Mitomycin is a cell cycle-specific drug that is most effective against tumor cells in the G1 phase, particularly in the late G1 and early S phases. It acts as a bifunctional or trifunctional alkylating agent after being activated by enzymes in the tissues. It can cross-link with DNA, inhibit DNA synthesis, and inhibit ribonucleic acid (RNA) and protein synthesis. It is also thought to possess antiscarring properties. As a result, mitomycin has been used in glaucoma trabeculectomy surgery to prevent scarring, and when satisfactory follicles are not obtained after trabeculectomy, it is used again. [13,14]

Despite the positive effect MMC has on filtering surgery success rates, its diffusion into adjacent ocular tissues may lead to toxic effects on cells not targeted during treatment. In present study we compared surgical outcome in patients with glaucoma treated with trabeculectomy done with and without the use of mitomycin C at a tertiary hospital

Material & Methods

This was a prospective, interventional, comparative study carried out, Regional Institute of Ophthalmology, IGIMS, Patna, Bihar, India. Study duration was of 2 years. During study period total 50 patients were operated for glaucoma.

Inclusion Criteria

- Patients of age more than 40 years, with primary open angle glaucoma/ primary angle closure glaucoma, intraocular pressure uncontrolled on anti-glaucoma medication with progressive visual field loss.

Exclusion Criteria

- Patients requiring combined surgery for cataract and primary open angle glaucoma
- Patients with secondary glaucoma, juvenile glaucoma, congenital glaucoma, patients with previous ocular surgery, patients with conjunctival scarring, patients with previously failed filtering surgery.

Methodology

Patients included in the study were explained about the procedure and expected results and risks were informed. Written and informed consent was taken. Patients underwent history taking, detailed ocular examination.

Grading for anterior chamber depth was done on the basis of Van Herrick's protocol. IOP was recorded on goldmann applanation tonometry. Gonioscopy was performed using Volk 4 mirror. Perimetry of each patient was performed on Humphrey field analyzer. Eyes with glaucoma progression was described with a mean deviation loss of 3dB or more from 'baseline' VFs to the most recent test. Open angle was diagnosed on gonioscopy with angles open, POAG was defined in the presence of an IOP > 21 mmHg, open anterior chamber angle on gonioscopy, glaucomatous optic disc damage on clinical examination, and corresponding glaucomatous visual field defects. PACG was defined in the presence of an occludable angle on gonioscopy (posterior trabecular meshwork not seen in at least 180° of the total circumference of the angle in primary position), glaucomatous optic disc damage, and corresponding glaucomatous visual field defects.

Patient were randomly assigned into 2 groups for conventional trabeculectomy with trabeculectomy with mitomycin C. Conventional trabeculectomy done with limbal based conjunctival incision. A limbus based rectangular graft was created, an inner rectangular scleral flap was excised with help of 11 no blade and vannas scissors so as to make an opening in the anterior chamber. A peripheral button hole iridectomy was done. The superficial flap was then closed. For eyes in MMC group, after preparing scleral flap, MMC (0.2 mg/ml) was applied by multiple thin sponges under the conjunctiva and scleral flap for 3 minutes. The area was then irrigated thoroughly with 50 cc balanced salt solution. Then sclerectomy and peripheral iridectomy was performed and scleral flap was closed. Post-operatively all patients were started on topical prednisolone eye drops 6 to 8 times a day, moxifloxacin eye drops 4 times a day, homatopine eye drops, 2 times a day. Antiglaucoma medications were continued in the other eye. All patients were examined in outpatient department on, 1st day, 5th day, weekly for 1 month, then each patient was followed every month for 3 months and then every 3 monthly up to 1 year. Patients were assessed on visual acuity, intraocular pressure, anterior chamber depth, immediate complications, anterior chamber depth, post-operative lens changes. Anterior chamber depth was assessed on slit lamp, central distance between anterior surface of lens and cornea.

Statistical Analysis

Data was collected and entered in Microsoft Excel for statistical analysis. Results of trabeculectomy only were compared with trabeculectomy with mitomycin C. The significance was calculated by paired 't' test and Fisher Exact test. p value less than 0.05 was considered as statistically significant.

Results

Table 1: Patients characteristics

Characteristics	Trabeculectomy only (n=25)	Trabeculectomy with mitomycin C (n=25)
Age in years (Mean ± SD)	62.4 ± 8.4	61.9 ± 11.1
Gender		
Male	10 (40%)	12 (48%)
Female	15 (60%)	13 (52%)
Laterality		
Right eye	10 (40%)	13 (52%)
Left eye	15 (60%)	12 (48%)
Glaucoma type		
Primary open angle	22 (88%)	20 (80%)
Primary angle closure glaucoma	3 (12%)	5 (20%)

25 patients were each randomly assigned to trabeculectomy only and trabeculectomy with mitomycin C groups. General characteristics such as age, gender, laterality and glaucoma type were comparable in both groups.

Table 2: Comparison of preoperative and postoperative characteristics

Characteristics	Trabeculectomy only (Mean ± SD)	Trabeculectomy with mitomycin C (Mean ± SD)	p value
Preoperative IOP	22.5 ± 4.16	21.19 ± 3.87	0.58
IOP at 6 month	12.36 ± 3.14	13.02 ± 3.24	0.22
IOP at 1 year	16.14 ± 3.90	13.47 ± 3.55	0.36
No. of IOP lowering preoperative medications	3.14 ± 0.32	2.84 ± 0.86	0.22
No. of IOP lowering medications at 6 month	0.8 ± 1.2	0.0	0.001
No. of IOP lowering medications at last visit	0.6 ± 1.24	0.0	0.001

In both groups statistically significant reduction was noted for intraocular pressure (IOP) and IOP lowering medications post-operatively. Characteristics such as preoperative intraocular pressure (IOP), IOP at 6 month, IOP at 1-year last visit and number of IOP lowering preoperative medications were comparable in both groups. Trabeculectomy with mitomycin C did not required any IOP lowering medications at 6 month and 1 year. A statistically significant difference was noted for number of IOP lowering medications at 6 month and 1 year between two groups.

Table 3: Post-operative complications

Post-operative complications	Trabeculectomy only		Trabeculectomy with mitomycin C	
	No. of patients	%	No. of patients	%
Iritis	3	12	1	4
Failed trabeculectomy	3	12	2	8
Hyphema	2	8	1	4
Hypotony	1	4	2	8
Hypopyon	1	4	2	8

Post-operatively failed trabeculectomy and iritis were common complications in both groups. Other complications were hyphema, hypotony and hypopyon.

Discussion

According to a review on blindness causes conducted by the World Health Organization, glaucoma is the first cause of non-reversible blindness and the second overall, after cataract. [15] The only known modifiable risk factor in open angle glaucoma is the elevated IOP, and disease progression can be prevented by the control of IOP. Glaucoma is usually treated with medical therapy but in certain situations like poor compliance of the patient and disease progression, invasive interventions such as laser trabeculoplasty and surgery, becomes the first choice of treatment. [16]

25 patients were each randomly assigned to trabeculectomy only and trabeculectomy with mitomycin C groups. General characteristics such as age, gender, laterality and glaucoma type were comparable in both groups. In both groups statistically significant reduction was noted for intraocular pressure (IOP) and IOP lowering medications post-operatively. Mitomycin C (MMC) is activated via enzymatic reduction into

metabolites that inhibit cell replication by inhibiting DNA synthesis, RNA transcription, and protein synthesis. MMC prevents scarring by inhibiting the multiplication of cells that produce scar tissue. [17] The dose and duration of MMC used in the literature have varied from 0.1 to 0.5 mg/ml and from 0.5 to 5 minutes. Low-dose MMC successfully achieves low target IOPs and results in significantly less thinning of the blebs. [18]

Rosentreter et al [19] compared 10 eyes each in trabeculectomy with MMC and Ologen groups and reported significantly higher complete success rate (IOP ≤ 18 mm Hg and at least 20% reduction of pre-operative IOP) at the end of 12 months in trabeculectomy with MMC group (100% with MMC vs. 50% with Ologen, P = 0.01). Characteristics such as preoperative intraocular pressure (IOP), IOP at 6 month, IOP at 1-year last visit and number of IOP lowering preoperative medications were comparable in both groups. Trabeculectomy with mitomycin C did not required any IOP lowering medications at 6 month and 1 year. A statistically significant difference was noted for number of IOP lowering medications at 6 month and 1 year between two groups. Aside from an increased risk of cataracts, the meta-analysis did not detect a difference in other adverse effects, such as rates of wound leak, hypotony, or endophalmitis. [20] Trabeculectomy with adjunctive MMC application intraoperatively increases surgical success. The efficacy of 0.2 mg/mL of MMC applied for a period of 2–3 minutes during surgery appears to be quite effective in clinical trials. [21] Napoli PE et al [22] compared filtering blebs with optical coherence tomography noted that blebs following MMC trabeculectomy had good functionality with low index of reflectivity and cystoid pattern.

Post-operatively failed trabeculectomy and iritis were common complications in both groups. Other complications were hyphema , hypotony and hypopyon. Progressive visual field loss after trabeculectomy was reported to be 50-60% after 10-22 years in a study conducted by Sihota et al [23] However, insignificant visual field loss was noted at final visit in a study with three years follow-up.4 Reibaldi A et al [24] noted that for MMC, long- term follow-up of a randomized clinical trial of trabeculectomy with MMC vs no MMC revealed no difference in safety outcomes, including leaks, hypotony, blebitis, and endophthalmitis. Sihota R et al [25] found greater corneal endothelial cell loss at three months in patients getting trabeculectomies with mitomycin than in those undergoing trabeculectomy without mitomycin.

Conclusion

Mean intraocular pressure (IOP) was reduced significantly at 12 months in trabeculectomy with MMC group compared to trabeculectomy without MMC. No significant difference was noted in complications from both groups.

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