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The effect of adjunctive Mitomycin C in Ahmed glaucoma valve implantation

E. KURNAZ, A. KUBALOGLU, Y. YILMAZ, A. KOYTAK, Y. ÖZERTÜRK

Department of Ophthalmology, Education and Research Hospital, Istanbul - Turkey

PURPOSE. *To evaluate the effectiveness and safety of adjunctive mitomycin C (MMC) in Ahmed glaucoma valve (AGV) implantation for refractory glaucoma.*

METHODS. *Twenty-two eyes of 22 patients who underwent AGV implantation with adjunctive MMC (0.5 mg/ml) for 3 minutes (Group A) were compared to a control group of 26 eyes of 26 patients (Group B) who received AGV implantation without MMC. Nine patients were female and 13 patients were male in Group A and 11 patients were female and 15 patients were male in Group B. The mean age was 56 years ranging from 13 to 77 in Group A and 58 ranging from 14 to 71 years in Group B. Success was defined as an intraocular pressure (IOP) between 4 and 21 mmHg with or without glaucoma medication and with no additional glaucoma surgery, phthisis, or loss of light perception.*

RESULTS. *The probability of success at 1 year was 86.36% and 80.76% in Group A and Group B, respectively. The number of glaucoma medications decreased from 2.82 to 0.56 in Group A and from 2.65 to 0.73 in Group B. Postoperative hypotony as an early complication was higher in Group A (31.81% in Group A and 15.38% in Group B). As a late postoperative complication, tube exposure developed in 3 patients (13.63%) in Group A and no such complication was seen in Group B. There was no statistically significant difference in success and complication rates between the two groups ($p>0.05$).*

CONCLUSIONS. *Although adjunctive MMC in AGV implantation is safe and effective, it may not offer a better chance of surgical success compared with AGV implantation without MMC. (Eur J Ophthalmol 2005; 15: 27-31)*

KEY WORDS. *Refractory glaucoma, Ahmed glaucoma valve, Mitomycin C*

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INTRODUCTION

Glaucoma drainage implants are used frequently to control intraocular pressure (IOP) in the treatment of refractory glaucoma (1, 2). These devices allow aqueous drainage from anterior or posterior chamber to subconjunctival space by silicone tube (3). Long-term success depends on the development of fibrosis around the plate, which decreases aqueous permeability. It has been suggested that the adjunctive use of antimetabolites with glaucoma drainage devices may be useful through inhibition of fibrosis around the capsule thereby increasing its permeability (4). The aim of this study is to evaluate whether the adjunctive use of mitomycin C (MMC) improves the surgical success in refractory glaucoma patients.

METHODS

Twenty-two eyes of 22 patients with refractory glaucoma (Group A) underwent Ahmed glaucoma valve (AGV) implantation with intraoperative MMC application (0.5 mg/ml, 3 minutes) from May 2000 to January 2004 at Kartal Education and Research Hospital. The patients were followed for at least 12 months.

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During the follow-up time, IOPs and complications were recorded. The results were compared to the records of a control group, which consisted of 26 eyes of 26 patients (Group B) who underwent AGV implantation without MMC application between March 1996 and April 2000.

The patients in Group B also had at least 1 year of follow-up time. All patients underwent AGV implantation in a similar surgical fashion performed by two different surgeons.

A limbal based conjunctival flap which included Tenon's capsule was made in either superior nasal or temporal quadrants approximately 7 to 8 mm posterior to the limbus. A cellulose sponge soaked in a 0.5 mg/ml solution of MMC was prepared, its size equal to the implant body. It was placed on the sclera under the conjunctiva and Tenon's capsule and left in position for 3 minutes. After removal of sponge, the area was irrigated with 40 ml of balanced salt solution (BSS, Alcon, Ft. Worth, TX). Three horizontal scleral incisions parallel to limbus at 1/2 scleral thickness were created 2, 4, and 6 mm posterior to the limbus. Then radial scleral tunnel was created by the help of crescent blade. The implant tubes were irrigated with BSS to control the valve mechanism. AGV was implanted in either superonasal or preferably superotemporal quadrant. The plate was then secured with 6/0 Vicryl sutures to the sclera. The tube tip was inserted into the scleral tunnel. Then the entry into the anterior chamber was made through a 23-gauge needle track 2 mm posterior to the limbus. Because the tube tip passes through the scleral tunnel in this technique, there was no need for the donor cornea, dura mater, or conjunctiva to cover the tube during the implantation in any patient. Viscoelastics were injected through side port into the anterior chamber if the anterior chamber became shallow. The conjunctiva and the Tenon's were sutured in separate layers after confirming that there was no leakage around the tube entry site. All eyes received subconjunctival injection of antibiotics and steroids at the end of the procedure.

The postoperative treatment included topical antibiotic drops and cycloplegic drops for 4 weeks and

TABLE I - DEMOGRAPHIC DATA

Characteristic		Group A	Group B
No. of patients		22	26
No. of eyes			
	Right	12	12
	Left	10	14
Sex			
	Female	9	11
	Male	13	15
Age, mean±SD, yr		56.59±20.41	49.81±13.86
Follow-up, mean±SD, mo		14.95± 1.99	16.31± 2.88
Diagnoses			
	NVG	12	14
	OAG	4	4
	Aphakia	4	4
	Post-PK glaucoma	2	1
	Traumatic	0	2
	Üveitis		1
Lens status, no. (%)			
	Phakic	4(18.18)	5(19.23)
	Aphakic	7(31.81)	6(23.07)
	Pseudophakic	11(50.00)	15(57.69)

NVG= Neovascular glaucoma; OAG= Open-angle glaucoma; PK= Penetrating keratoplasty

topical steroids for 3 months. During follow-up, antiglaucoma medications were added if the IOP was found to be too high. The postoperative controls were performed after 1 day, 1 week, 1 month, and every 3 months thereafter.

During these controls, IOP measurements and slit lamp examinations were performed and complications were recorded. Surgical success was defined as an IOP above 4 mmHg and below 21 mmHg with or without medications. In this study, we enrolled the patients who were followed for at least 1 year.

For statistical analyses, Student t-test was used for continuous variables. A chi-square test was used to compare the two groups. Statistical significance was defined as $p<0.05$.

RESULTS

Table I summarizes the demographic data. Nineteen patients (86.36%) had successful IOP control with or without additional glaucoma medications in Group A (13 patients without medications and 6 patients with medications), whereas 21 patients (80.76%) were controlled successfully with or without medications in Group B (8 patients without medications and 13 patients with medications). Table II shows IOP changes with time. In Group A, the number of antiglaucoma medications decreased from 2.82 preoperatively to 0.56 postoperatively. In Group B, the number of antiglaucoma medications decreased from 2.65 preoperatively to 0.73 postoperatively. The most frequent postoperative complications in both groups were early postoperative hypotony and hyphema.

In Group A, tube exposure in three patients, vitreous hemorrhage in one patient, and the late postoperative hypotony in one patient were observed. In Group B, such complications were not observed.

In Group B, fibrinous membrane formation in two patients and corneal epithelial defect in one patient were observed, but in Group A, we did not see such complications. Early and late postoperative complications in both groups are shown in Table III.

TABLE II - COMPARISON OF MEAN ±SD PRE- AND POSTOPERATIVE IOP (mmHg)

Time	Group A	Group B	p
Pre-op	39.55±9.29	42.27±8.95	0.307
1 week	10.95±8.58	11.42±9.70	0.860
1 month	14.73±7.75	15.15±7.05	0.843
3 months	13.68±7.48	16.35±7.71	0.233
6 months	16.36±11.55	18.23±10.49	0.560
12 months	17.59±9.22	19.15±10.91	0.598

IOP = Intraocular pressure

TABLE III - EARLY AND LATE POSTOPERATIVE COMPLICATIONS

Complications	Group A	Group B	p
Hypotony (early)	7(31.81)	4(15.38)	0.185
Hyphema	3(13.63)	5(19.23)	0.613
Shallow anterior chamber	3(13.63)	2 (7.69)	0.512
Corneal edema	3(13.63)	2 (7.69)	0.512
Tube exposure	3(13.63)	0	0.083
Choroidal detachment	2 (9.09)	1 (3.84)	0.465
Tube blockage	1 (4.54)	1 (3.84)	0.906
Vitreous hemorrhage	1 (4.54)	0	0.282
Phthisis	1 (4.54)	2 (7.69)	0.662
Hypotony (late)	1 (4.54)	0	0.282
Fibrinous membrane formation	0	2 (7.69)	0.192
Corneal epithelial defect	0	1 (3.84)	0.363

Values are n (%)

DISCUSSION

Many reports have evaluated the effects of adjunctive use of MMC during the implantation of non-valved devices on postoperative IOP control. Although some of these studies reported higher success rates after the use of intraoperative MMC (4, 5), the majority of these studies suggested that the use of intraoperative MMC is not effective in increasing the success rates (6-10). Some authors reported higher complication rates in MMC groups (4, 11). However, the number of studies evaluating the effect of the adjunctive use of MMC with a valved device is limited.

AGV consists of a silicone tube that is connected to a silicone sheet valve held in a polypropylene body. The valve is placed in the body and designed to open when the IOP is greater than 8 mmHg and thus reduce early postoperative hypotony (12, 13). Long-term failure in IOP control is related to the formation of fibrous capsule around the plate (14). Since the local antiproliferative agents such as MMC and 5-FU have been widely used in glaucoma filtering surgery for improved and prolonged bleb function by decreasing the formation of fibrous capsule and increasing the permeability of fibrous sac, more attention has been given to the use of these agents in drainage implants as well (4, 15, 16).

In our study, which reviewed 22 eyes of 22 patients, the success rate in terms of IOP control at 1 year was higher in Group A than in the control group (86.36% vs 80.76%). Success rates of similar procedures found in the literature are reported between 73.8% and 87% (1, 12, 17-20). The mean preoperative IOP in Group A was 39.55±9.29 mmHg and at last control, the mean IOP was 17.59±9.22 mmHg. In the control group, the mean preoperative IOP was 42.27±8.95 mmHg and decreased to 19.15±10.91 mmHg at last control. There was no statistically significant difference between the groups (Tab. II).

Because the aim in the refractory glaucoma is to reduce IOP to normal level, visual acuity was not included in the success criteria. The most frequent complication was early postoperative hypotony, which was seen in 7 eyes (31.81%). The diagnoses in these eyes were neovascular glaucoma in five eyes, aphakia in one eye, and traumatic glaucoma in one eye. No additional procedures were needed for these eyes. Spontaneous resolution occurred in all eyes between 3 and 15 days. Digital massage was applied to the eyes with high IOP. In the control group, hypotony was the second most frequent complication, seen in 4 eyes (15.38%). There was no statistically significant difference between the complication rates in both groups (Tab. III). Kook et al also reported in their study with AGV implantation with MMC that the most frequent complication was hypotony (17%) and this was similar to other reports that used AGV without MMC (19). In the literature, the rate of early postoperative hypotony is reported between 8 and 17% (1, 12, 17-20).

Hyphema, shallow anterior chamber, corneal edema, and tube exposure were the next most frequent complications. Three eyes with NVG developed hyphema: two of these eyes underwent anterior chamber irrigation and the other eye spontaneously resolved. In one of three eyes with shallow anterior chamber, viscoelastics were injected into anterior chamber thorough side port. The other two eyes spontaneously resolved. Ayyala et al reported that endplate or tube exposure was the most common indication for secondary surgical intervention (1). In our study, tube exposure occurred in three eyes due to conjunctival or episcleral erosions. In all these three eyes with exposure, donor cornea was used for repair. In the literature, it has been reported that conjunctiva or dura mater can be used for the repair of the exposed implants (21, 22).

We choose the area where AGV would be implanted depending on the situation of conjunctiva, cornea, anterior chamber, peripheric anterior synechia, and iris. The risk of damage to optic nerve and posterior ciliary artery increases when the AGV is implanted in superior nasal quadrant where the length between limbus and optic nerve is relatively shorter, especially in patients with short axial length (23, 24). It has been suggested that when the implantation of AGV is performed in superior temporal quadrant, there is increased risk of chorioretinal folds in macula, metamorphopsia, and refractive changes due to formation of bleb around the valve (25). In our study, we did not observe localization-related complications.

In summary, AGV implantation is effective and safe in refractory glaucoma. Although the intraoperative adjunctive use of MMC is safe, the success rate ap-

pears to be no better than that of a control group without MMC. However, longer follow-up and more cases are required to evaluate the role of adjunctive MMC in AGV implantation.

Reprint requests to
Ekrem Kurnaz, MD
Atatürk Cd. No: 52/46
Maltepe-Istanbul-Turkey
ekremkurnaz@hotmail.com

REFERENCES

1. Ayyala RS, Zurakowski D, Smith JA, et al. A clinical study of the Ahmed glaucoma valve implant in advanced glaucoma. Ophthalmology 1998; 105: 1968-76.
2. Hauber F. Artificial drainage implants in glaucoma. Ophthalmic Practice 1994; 12: 3-7.
3. Zorab A. The reduction of tension in chronic glaucoma. Ophthalmoscope 1912; 10: 258-61.
4. Perkins TW, Cardakli F, Eisele JR et al. Adjunctive mitomycin C in Molteno implant surgery. Ophthalmology 1995: 102; 91-7.
5. Perkins TW, Gangnon R, Ladd W, et al. Molteno implant with mitomycin-C: intermediate-term results. J Glaucoma 1998; 7: 86-92.
6. Susanna R Jr, Nicolela MT, Takahashi WY. Mitomycin C as adjunctive therapy with glaucoma implant surgery. Ophthalmic Surg 1994; 25: 458-62.
7. Lee D, Shin DH, Birt CM, et al. The effect of adjunctive mitomycin C in Molteno implant surgery. Ophthalmology 1997; 104: 2126-35.
8. Azuara-Blanco A, Moster MR, Wilson RP, Schmidt CM. Simultaneous use of mitomycin C with Baerveldt implantation. Ophthalmic Surg Lasers 1997; 28; 992-7.
9. Trible JR, Brown DB. Occlusive ligature and standardized fenestration of a Baerveldt tube with and without antimetabolites for early postoperative intraocular pressure control. Ophthalmology 1998; 105: 2243-50.
10. Cantor L, Burgoyne J, Sanders S, et al. The effect of mitomycin-C on Molteno implant surgery: A 1-year randomized, masked prospective study. J Glaucoma 1998; 7: 240-6.
11. Costa VP, Moster MR, Wilson RP, et al. Effects of topical mitomycin C on primary trabeculectomies and combined procedures. Br J Ophthalmol 1993; 77: 693-7.
12. Coleman AL, Hill AR, Wilson MR, et al. Initial clinical experience with the Ahmed glaucoma valve implant. Am J Ophthalmol 1995; 120: 23-31.
13. Francis BA, Cortes A Chen J, Alvarado JA. Characteristics of glaucoma drainage implants during dynamic and steady-state flow conditions. Ophthalmology 1998; 105: 1708-14.
14. Azuara-Blanco A, Moster MR, Wilson RP, et al. Simultaneous use of Mitomycin-C with Baerveldt implantation. Ophthalmic Surg Lasers 1997; 28: 992-997.
15. Bergstrom TJ, Wilkinson WS, Skuta GL, et al. The effects of subconjunctival mitomycin-C on glaucoma filtrasyon surgery in rabbits. Arch Ophthalmol 1991; 109: 1725-30.
16. Mietz H, Brunner R, Addicks K, Krieglstein GK. Histopathology of an avascular filtering bleb after trabeculectomy with mitomicyn-C. J Glaucoma 1993; 2: 226-70.
17. Huang MC, Netland PA, Coleman AL, et al. Intermediate-term clinical experience with the Ahmed glaucoma valve implant. Am J Ophthalmol 1999; 127: 27-33.
18. Lai JSM, Poon ASY, Chua JKH, et al. Efficacy and safety of Ahmed glaucoma valve implant in Chinese eyes with complicated glaucoma. Br J Ophthalmol 2000; 84: 718-21.
19. Kook MJ, Yoom J, Kim J, Lee MS. Clinical results of Ahmed glaucoma valve implantation in refractory glaucoma with adjunctive mitomicyn C. Ophthalmic Surg Lasers 2000; 31: 101-6.
20. Topouzis F, Coleman AL, Cholin N, el al. Follw-up of the original cohort with Ahmed glaucoma valve implant. Am J Ophthalmol 1999; 128: 198-204.
21. Brandt JD. Patch grafts of dehydrated cadaveric duramater for tube-shunt glaucoma surgery. Arch Ophthalmol 1993; 111: 1436-40.
22. Watzke R. Scleral patch graft for exposed episcleral implants. Arch Ophthalmol 1984; 102: 114-6.
23. Leen MM, Witkop GS, George DP. Anatomic considerations in the implantation of the Ahmed glaucoma valve. Arch Ophthalmol 1996; 114: 223-4.
24. Ayyala RS, Layden WE, Slonim CB, Margo CE. Anatomic and histopathologic findings following a failed Ahmed glaucoma valve device. Ophthalmic Surg Lasers 2001; 32: 248-249.
25. Sibayan SAB, Latina MA. Chorioretinal folds following glaucoma valve implantation. Ophthalmic Surg Lasers 1998; 29: 242-3.
26. Yaldo MK, Stamper RL. Long-term effects of mitomycin on filtering blebs: lack of fibrovascular proliferative response following severe inflammation. Arch Ophthalmol 1993; 111: 824-6.
27. Hutchinson AK, Grossniklaus HE, Brown RH, et al. Clinicopathologic features of excised mitomycin filtering blebs. Arch Ophthalmol 1994; 112: 74-9.