

A comparative study between trabeculectomy with mitomycin-C and conventional trabeculectomy

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Abstract

Aim: The aim of this study was to assess the efficacy and safety of trabeculectomy in primary open-angle glaucoma (POAG) patients, compared with surgical treatment.

Methods: This study included cases that were diagnosed with primary open angle glaucoma and were eligible to undergo surgery in Tirana, Albania. Overall, 52 patients affected by POAG were examined and randomly scheduled to undergo trabeculectomy with mitomycin-C (MMC), or conventional trabeculectomy. Data collection included demographic characteristics, the number of preoperative medications, data before and after the intervention and comparison between the values obtained from the measurement of intraocular pressure, visual fields, visual acuity, interpretation of filtering bleb functionality and post-operative complications.

Results: Overall, 52 eyes underwent glaucoma surgery. Of these, 24 eyes were assigned to the first group (group 1) treated with MMC trabeculectomy and 28 eyes were assigned to the second group (group 2) treated with conventional trabeculectomy. In both groups of patients it was observed a significant reduction of IOP ($P < 0.001$). The decrease of IOP was more pronounced in the group with MMC. Only 10.7% of the patients in the group without MMC and 8.3% of the patients in the group with MMC suffered visual field deterioration. Cataract occurred with the same frequency in both groups despite the use of MMC.

Conclusion: POAG patients treated with trabeculectomy with and without MMC have very good outcomes with a low incidence of complications and result in similar statistical changes. Therefore, we consider that the indications for use of MMC should be in cases such as the failure of conventional trabeculectomy, a very low target pressure and excessive proliferative processes.

Keywords: mitomycin-C, open angle glaucoma, trabeculectomy, visual acuity, visual field.

Introduction

Trabeculectomy remains the worldwide standard surgery for glaucoma (1-4). This surgery involves creating a window in the eye wall in order to improve fluid outflow and decrease intraocular pressure. However, success rates range from 75% to 92% depending on the criteria used and tend to decrease with time (5-7). The failure of the surgery is associated with inflammation, new blood vessel formation and scarring which can cause closure of the window (8-10).

The aim of this study was to assess the efficacy and safety of trabeculectomy with mitomycin-C (MMC) and conventional trabeculectomy in primary open-angle glaucoma (POAG) patients.

A study with a shorter follow-up reported a success rate of 67% using intraoperative mitomycin C as an adjunctive therapy to trabeculectomy performed for the treatment of congenital or developmental glaucoma (11).

There has been no former similar study on this matter in Albania.

Methods

This was a case-control study conducted during 2010-2012 including two randomized patient groups subject to two different surgical methods used by

us for treatment of patients with open-angle glaucoma: 24 eyes treated with trabeculectomy MMC (group 1) and 28 eyes treated with trabeculectomy without MMC (group 2). The population group consisted of cases attending the Cabinet of Glaucoma at the University Clinic, during the study period, which were diagnosed with primary open angle glaucoma and were eligible to undergo surgery. The overall number of patients included in the study was 52. Divided by gender there were 24 males (46.2%) and 28 females (53.8%). It was noted that this is the most common pathology of the age group 51-80 years.

The number of topical medicaments used by patients was assessed before the surgical treatment. It was noted that in both cases, the predominant treatment regimen consisted of three medications.

In 52 cases included in the study the average IOP value before the intervention was 28.07 mmHg. In the case of patients treated without MMC, the average IOP value was 27.94 mmHg (fluctuating from 17.3 mmHg to 49.8 mmHg). In the case of patients treated with MMC, the average value of IOP was 28.23 mmHg (fluctuating from 20.60 mmHg to 60 mmHg). Such benchmark data are presented in Table 1.

Table 1. Average value of IOP in mmHg

Parameter	Total	Group without MMC	Group with MMC
Average IOP	28.07	27.94	28.23
Max IOP	60	49.80	60
Min IOP	17.30	17.30	20.60
Standard deviation	9.60	8.91	10.54

Best corrected visual acuity (BCVA) was measured in all subjects. Table 2 presents the average values of the VA in the whole study group and in the groups of patients treated with and without MMC.

The cupping was measured and interpreted as the average ratio between the cup and disc. In the cases included in the study was 0.85, with a minimum value of 0.30 (indicating the relatively good condition of the patient) and the maximum

Table 2. The average values of the VA in the whole study group

Parameter	Total	Group without MMC	Group with MMC
Average BCVA	0.4583	0.4308	0.4905
Max BCVA	1.00	0.00	0.00
Min BCVA	0.00	1.00	1.00
Standard Deviation	0.3708	0.3508	0.3980

value of 1 (which shows the end stage). Before the intervention 15.4% of the patients had moderate injuries (the ratio between the cup and disc = 0.3-0.7), while 84.6% of them had a serious injury (the ratio between the cup and disc > 0.7). In the patients who were treated with TRAB with MMC, the average of cup to disc ratio was 0.75, with the minimum value and maximum value of 0.3-1.0 and

in the case of the patients who were treated with TRAB without MMC, the average ratio between the cup and the disc was 0.85, with the minimum and maximum value of 0.4-0.85 cup to disc ratio. These comparative data presented in Table 3. We noted that in the group treated with mitomycin, 92.8% of the patients had a serious injury versus 75% of the cases treated without mitomycin.

Table 3. Comparative data of cup to disc ratio

Parameter	Total	Group without MMC	Group without MMC
Average Cup to Disc ratio	0.85	0.85	0.75
Max Cup to disc ratio	1.00	0.95	1.00
Min Cup to disc ratio	0.30	0.40	0.30
Standard Deviation	0.155	0.108	0.194

Results

On the whole, 52 patients were included in this study of whom 24 (46.2%) were males and 28 (53.8%) were females, with an average age of 63.65 years. In both groups, most of the patients were taking maximal antiglaucoma medications. About 57% of the patients in Group 1 and 67% of the patients in Group 2 were taking three antiglaucoma medications. Overall, 52 eyes underwent surgical treatment surgery for glaucoma, from which 24 eyes were treated with trabeculectomy with MMC (Group 1) and 28 eyes were treated with conventional trabeculectomy (Group 2). The analysis of data collected before the intervention and after the intervention in both groups was performed and compared between the values obtained from the measurement of intraocular

pressure, visual fields, visual acuity, interpretation of filtering bleb functionality and post-operative complications.

Intraocular pressure (IOP)

The values from the measurement of intraocular pressure (IOP) were obtained as the most important parameter to define the success of the surgical procedure. In both groups of patients was observed significant reduction of IOP ($P < 0.001$). The reduction in IOP is more significant in MMC-treated group compared to the group treated without MMC (15.81 mmHg vs. 14.6 mmHg). We noted that in both levels of IOP (12.20 mmHg and 14.60 mmHg), cases treated with mitomycin comprised the most success-

ful cases (Table 4). This finding was also statistically significant ($P < 0.05$). Group 1: 75% of the cases treated with mitomycin after a year displayed a PIO $< 12/20$ mmHg, and 87.5% of these cases represented an IOP < 14.60 mmHg. There was a mean IOP

of 11.22 mmHg after 12 months. Group 2: 53% of the cases treated with mitomycin after a year displayed a PIO $< 12/20$ mmHg, and 75% of these cases represented an IOP < 14.60 mmHg. There was a mean IOP of 10.76 mmHg after 12 months.

Table 4. Normal values

Values e IOP ₁₂	Cases without MMC (N = 28)	Cases with MMC (N = 24)	P-value
≤ 12.20	15 (53%)	18 (75%)	p = 0.04
≤ 14.60	21 (75%)	21 (87.5%)	p = 0.02

Visual fields

The second important parameter to define the success of the surgical procedure is the stability of changes in the visual fields. The perimeter Humphrey stat-pack 2 was used to measure the visual fields of the patient in both groups before the surgery and 12 months after the surgery.

Group 1: 20 (83.3%) eyes had no progression at 12 month; 2 (8.3%) eyes had further glaucoma damage progression at 12 month and 2 (8.3%) eyes had slight improvement at 12 month.

Group 2: 25 (89.3%) eyes had no progression at 12 month and 3 (10.7%) eyes had further glaucoma damage progression at 12 month.

Visual acuity

Although in the first few months it appears a parallel trend between cases treated with and without mitomycin, at the end of the first year it seems that

the performance of the average corrected visual acuity in the group treated with MMC is positive. It is noticed a decrease in the range of 0.053 Snellen lines in the group without MMC compared to a decrease of only 0.013 lines in the group treated with MMC. Another test conducted to compare the performance of the sharpness of vision was the comparison between the best corrected visual acuity before surgery and each of the months during which became the tracking of patients. The test used for this purpose was paired samples Test (Paired Samples t-test). These results are presented in Table 5.

In the twelfth month after the intervention, BCVA was maximally approximated to BCVA before the surgery and provides durability. The clinical significance of the stabilization of the BCVA is seen as a very important indicator of the success of surgery.

Table 5. The difference between the best corrected visual acuity before the surgery and one year after the surgery (BCVA₀ – BCVA₁₂)

Treated group	Difference	95%CI	P-value
Without MMC	0.053	-0.013 ÷ 0.119	0.112
With MMC	0.013	-0.040 ÷ 0.065	0.628
Total	0.034	-0.008 ÷ 0.077	0.108

Bleb functionality

We noted that in the group with MMC there were no fibrotic blebs.

Group 1: 11 treated eyes (45.8%) had optimal bleb type I; 13 treated eyes (54.2%) had optimal bleb type II. There was no fibrotic bleb.

Group 2: 16 treated eyes (60.7%) had optimal bleb type I; 8 treated eyes (32.1%) had optimal bleb type II and 2 treated eyes (7.2%) had fibrotic bleb.

Complications

According to the literature, the complications of surgery include: leakage from the wound, hypotonia, endophthalmitis, bleeding into the anterior chamber, expulsive hemorrhage, shallow anterior chamber and secondary cataract.

The main complications observed in our patients were: cataract (47.6%), shallow anterior chamber (28.70%), hemorrhage into the anterior chamber (23.8%) and hypotonia.

Hypotonia constitutes a complication that occurs in patients developing shallow anterior chamber, in early postoperative follow-up, in six eyes (37.5% of the cases with shallow AC, or 25% of cases in total) in the group treated with MMC and in two eyes

(22.2% of the cases with shallow AC, or 7% of cases in total) in the treated group without MMC.

Group 1: 66.7% of the eyes had shallow anterior chamber, 50% of the eyes had cataract and 80% of the eyes had hemorrhage into the AC.

Group 2: 33.3% of the eyes had shallow anterior chamber, 50% of the eyes had cataract and 20% of the eyes had hemorrhage into AC.

There were no cases of blebitis or endophthalmitis. In our clinical study and based on the recommendations of the literature (4), the target value of IOP is 12.2 mmHg. Table 6 shows the trend in the value of the PIO over time. The next step of the analysis was to compare the results and the viability of IOP reduction one year after the intervention. The decrease in IOP level is expressed in MMC-treated group compared to the group treated without MMC (15.81 mmHg vs. 14.6 mmHg). About 75% of the cases treated with mitomycin after one year displayed a PIO <12/20 mmHg, and 87.5% of these cases represented an IOP <14.60 mmHg. We noted that in both levels of IOP-s (12.20 mmHg and 14.60 mmHg), patients treated with mitomycin comprised the most successful cases (Table 4). This finding was also statistically significant ($P < 0.05$).

Table 6. The trend in the value of the PIO over time

	Total	without MMC	with MMC
IOP ₀	28.07 mmHg	27.94 mmHg	28.23 mmHg
IOP ₁	12.78 mmHg	13.28 mmHg	12.21 mmHg
IOP ₂	13.08 mmHg	13.68 mmHg	12.40 mmHg
IOP ₄	13.01 mmHg	13.80 mmHg	12.08 mmHg
IOP ₆	13.24 mmHg	13.82 mmHg	12.57 mmHg
IOP ₁₂	13.21 mmHg	13.88 mmHg	12.42 mmHg

It was noted that the results related to changes in the visual field were similar in both groups. About 10.7% in the group treated without MMC and 8.3% in the group treated with MMC demon-

strated progress in the field of vision changes (deterioration). On the other hand, two of the patients treated with MMC represented an improvement in the depth of preoperative scotoma.

Conversely, the majority (86.5%-89.3% in the group without MMC and 91.6% in the group with MMC) demonstrated stability of changes in the visual field (the main purpose of the intervention).

The best corrected visual acuity was assessed before the intervention (BCVA0), the first month (BCVA1), the second (BCVA2), the fourth (BCVA4), the sixth (BCVA6) and the twelve month (BCVA12) after the intervention. Although in the first few months appeared a parallel trend between cases with and without mitomycin treatment, at the end of the first year's performance there was evidence that the average visual corrected acuity in the group treated with MMC was positive. It was estimated a decline in the rate of 0.053 Snellen lines in the group treated without MMC in relation to a single drop of 0.013 lines in the group treated with MMC. Regarding the interpretation related to the functionality of filtering bleb, we noted that in 24 eyes (100% of the cases) treated with MMC there was evidence of formation of an optimal filtering bleb and no cases represented fibrotic blebs, whereas in the group without MMC there were 26 eyes (92.8% of patients) with optimal filtering blebs and only two eyes (7.2% of them) represented fibrotic blebs. This finding was statistically significant although not showing the advantage of treatment with MMC.

According to the literature, the complications related to trabeculectomy with or without MMC include leakage from the wound, hypotony, endophthalmitis, bleeding into the anterior chamber, shallow anterior chamber, cataract, and expulsive hemorrhage (12). In our study, the highest percentage of the cases included cataracts (50% of the patients), whereas other complications of shallow anterior chamber and bleeding into the anterior chamber had almost the same frequency.

Discussion

The number of patients included in this study was 52, of whom 24 (46.2%) were males and 28 (53.8%) were females. The age group of the patients included in this study ranged from 51 to 80

years old. Evaluation of results after surgical intervention resulted as follows: in both groups of patients it was observed a significant reduction of IOP ($P < 0.001$). The decrease of IOP was more pronounced in the group with MMC (with 15.81 mmHg vs. 06.14 mmHg). Thus, 75% of the cases treated with mitomycin after a year displayed a PIO $< 12/20$ mmHg, and 87.5% of these cases represented an IOP < 14.60 mmHg, a finding which is comparable with the results of the nine-year study published in 2008, according to which around 75-91% of the patients achieved pressure < 15 mmHg. Only 10.7% of the patients in the group without MMC and 8.3% of the patients in the group with MMC suffered visual field deterioration. This value is higher than in literature studies (4), and values ranging from 27% to 42% in a 10-year follow-up in contrast to our study that had a 1-year follow-up only.

In the group with MMC, all cases were classified with "optimal filtering blebs" while in the group without MMC there were two patients who suffered a complication known as "fibrotic blebs" that means the failure of surgery. Cataract occurs with the same frequency in both groups despite the use of MMC; our study shows a higher degree of cataract incidence in relation to other studies with about 10% more (15).

Blebitis or endophthalmitis has not been seen in any case. The literature reports on endophthalmitis range from 0.8% to 3.0% and usually refers to post-operative follow-up > 5 years (16).

In conclusion, all patients with an indication for surgical intervention should be selected to undergo the most appropriate surgical technique with lower rate of complications. The setting of a target pressure and tracking of changes in glaucomatous visual field damage are more valuable guidelines for the assessment of the case. Since the statistical differences found to be approximate in both groups, as claimed as presented in the literature (13), we consider that the indications for using MMC should be carefully selected and we recommend its use

when the conventional trabeculectomy has failed, when it is required a very low target pressure and this pressure is not achieved with the maximum

drug therapy or conventional trabeculectomy, or when the proliferative processes are excessive such as in young and black patients (14).

Conflicts of interest: None declared.

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