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Efficacy and safety of mitomycin C – augmented revisions of non-functioning filtering blebs after trabeculectomy – 7 year results

Skuteczność i bezpieczeństwo rewizji wspomaganej mitomycyną C niefunkcjonalnej przetoki po trabekulektomii – wyniki 7-letniej obserwacji

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Streszczenie: Cel: określenie skuteczności i bezpieczeństwa rewizji wspomaganej mitomycyną C w oczach po przebytej trabekulektomii.
Materiał i metody: retrospektywnie oceniano 40 oczu pacjentów, u których wykonano wspomaganą mitomycyną rewizję przetoki po trabekulektomii. Badano następujące parametry: ciśnienie wewnątrzgałkowe, najlepszą skorygowaną ostrość wzroku, liczbę stosowanych leków przeciwjaskrowych, powikłania. Maksymalny czas obserwacji wynosił 84 miesiące.
Wyniki: po 12 miesiącach od rewizji średnie ciśnienie wewnątrzgałkowe zostało obniżone z 24,5 ± 6,7 mmHg do 15,4 ± 4,4 mmHg ($p<0,05$). Po 24 miesiącach wynosiło ono 16,33 ± 4,2 mmHg, a po 84 miesiącach – 16,75 ± 2,8 mmHg. W 17 przypadkach (42,5%) osiągnięto całkowity sukces, definiowany jako ciśnienie wewnątrzgałkowe ≤ 18 mmHg bez podawania leków 12 miesięcy po rewizji. Leczenie 14 oczu (35,0%) zakończyło się częściowym sukcesem, określonym jako ciśnienie wewnątrzgałkowe ≤ 18 mmHg po podaniu leków je obniżających, natomiast w 9 spośród 40 przypadków (22,5%) nie uzyskano ciśnienia wewnątrzgałkowego < 18 mmHg. Najlepsza skorygowana ostrość wzroku nie zmieniła się istotnie po rewizji po 12 miesiącach ($p = 0,76$), 36–48 miesiącach ($p = 0,25$) oraz 72–84 miesiącach ($p = 0,15$). Zabieg pozwolił na istotnie statystycznie zredukowanie średniej liczby leków: z 1,2 ± 0,8 przed operacją do 0,68 ± 0,8 dwanaście miesięcy po rewizji i do 0,78 ± 0,49 po 24 miesiącach ($p<0,05$). Wczesne i samoustępujące powikłania wystąpiły u 7 pacjentów (17,5%).
Wnioski: rewizja wspomagana MMC jest bezpiecznym, prostym technicznie zabiegiem, który przywraca funkcjonowanie pęcherzyka i pozwala na uniknięcie bardziej inwazyjnych technik chirurgicznych uszkadzających spojówkę. Skuteczność rewizji maleje jednak z czasem.

Słowa kluczowe: mitomycyna C – MMC, rewizja, trabekulektomia, pęcherzyk filtracyjny.

Abstract: Purpose: To determine the efficacy and safety of mitomycin C-augmented revision in eyes after failed primary trabeculectomy failure.
Material and methods: Retrospective review of 40 eyes after a single MMC-augmented revision due to primary trabeculectomy failure. Main outcome measures: intraocular pressure, best corrected visual acuity, number of antiglaucoma medications, complications.
Results: Twelve months after revision the mean intraocular pressure declined from 24.5 ± 6.7 mmHg to 15.4 ± 4.4 mmHg ($p<0.05$) and remained decreased at 24 months (16.33 ± 4.2 mmHg) and at 84 months (16.75 ± 2.8 mmHg). The therapeutic success, defined as intraocular pressure ≤ 18 mmHg without medication at 12 months after revision, was achieved in seventeen eyes (42.5%). Fourteen eyes (35.0%) achieved qualified success, defined as intraocular pressure ≤ 18 mmHg with antiglaucoma medication, and 9 of 40 eyes (22.5%) were classified as failures. Mean best corrected visual acuity did not change significantly after the surgery (12 month: $p = 0.76$, 36–48 months: $p = 0.25$, 72–84 months: $p = 0.15$). The mean number of medications was reduced from 1.2 ± 0.8 preoperatively to 0.68 ± 0.8 postoperatively at 12 months, to 0.78 ± 0.49 at 24 months and the drop was statistically significantly. Early complications developed in 7 (17.5%) eyes but they resolved spontaneously.
Conclusions: MMC-augmented revision appears to be a safe and useful tool in reducing intraocular pressure after trabeculectomy failure. This simple-technique procedure is successful in 42.5% of eyes for up to 24–36 months and helps protect the eye from other surgical intervention, more destructive for the conjunctiva.

Key words: Mitomycin C – MMC, revision, trabeculectomy, filtering bleb.

Introduction

Trabeculectomy is a standard surgical filtering procedure for treating patients who failed maximal tolerated medical therapy. However, it has limitations due to healing process and some of these procedures end with failure. Filtering bleb failure occurs at various times after the trabeculectomy.

Scarring of the bleb site is most commonly due to fibrosis involving episcleral, Tenon capsule and subconjunctival tissue (1). Clinical signs of scarring include increased intraocular pressure, bleb vascularization and flattening. The challenge to maintain a functional filtering bleb consists in preventing the natural healing process from closing the filtration channel. There are different methods to obtain this. Once scar tissue forms at the filtering site, the patient may need to resume medical treatment including: digital massage, removal of releasable-suture, laser suture lysis, repeated filtration surgery, a revision or placement of glaucoma drainage implant (2).

Although a second trabeculectomy may be necessary, its outcomes can be similar to the first one, with further conjunctival destruction. The second full-thickness procedure is generally more time consuming and prone to intraoperative bleeding. The subsequent failure rate is higher than in the primary setting due to more dramatic inflammation, scarring and associated complications. In order to improve the success rate of filtration surgery steroids, bevacizumab (Avastin) (3, 4) and antifibrotic agents such as 5-fluorouracil (5FU) or mitomycin C (MMC) may be applied to reduce scarring. MMC applied transconjunctivally may also enhance success of the procedure in failing filtering blebs (5).

One method to improve the function of fibrosed filtering blebs with no risk of repeating drainage surgery is a subconjunctival revision with an adjunctive antimetabolite administration. The aim of our retrospective study was to determine the efficacy and safety of subconjunctival revision performed with the intraoperative adjunctive use of MMC in eyes after primary trabeculectomy failure, due to postoperative fibrosis.

Material and methods

The design of the research was 84-month retrospective study.

Patients after primary trabeculectomy failure with increased intraocular pressure (IOP) alone were considered as candidates for MMC-revision. MMC-revision was performed as a primary procedure or after resumed medical therapy with inadequate pressure control. The study group was composed of patients with a single revision after a primary trabeculectomy who had not undergone additional surgery during the observation period. Patients with the history of cataract surgery, additional revision or antiglaucoma procedure were excluded.

The study group consisted of 40 eyes of 37 Caucasian patients; 21 females (24 eyes) and 16 males (16 eyes), aged 32–88 years (mean age 69.1 y). Primary open-angle glaucoma (POAG) was diagnosed in 32 cases (80%), pseudoexfoliative glaucoma (PEXG) in 4 cases (10.0%), primary angle closure glaucoma (PACG) in 3 cases (7.5%) and pigmentary glaucoma in 1 case (2.5%).

All patients had a complete preoperative ophthalmic examination, including best corrected visual acuity (BCVA), applanation tonometry, slit lamp examination, ophthalmoscopy, gonioscopy and visual field examination (Humphrey perimeter, SITA Standard 30-2 program). Written informed consent was obtained from each patient before the procedure. The failed filtration blebs created during trabeculectomy were assessed and classified on the basis of morphological features at slit-lamp examination into: cystic blebs, diffuse blebs, and small flat blebs.

Revision augmented with MMC – procedure

MMC-revision after trabeculectomy was described by many authors in a similar way (6–8). In this study, local anesthesia was administered as subconjunctival injection of 1% lidocaine and anterior chamber irrigation with 1% lidocaine. The subconjunctival space was accessed with 26 G disposable needle inserted 5–10 mm distal to the desired injection site and then guided beneath the conjunctiva towards the failed filtration bleb site and eventually beneath the scleral flap through the dense scar tissue, repeatedly 3–5 times using sweeping motions. The cutting edges of the needle tip were used for dissection until free movement without resistance was attained or, if necessary, using forward-backward motion until local elevation of the conjunctiva was observed due to increased filtration and the egress of aqueous humor. Then the needle tip was inserted under direct visualization underneath or through the scleral flap to the level of the sclerotomy into the anterior chamber in an attempt to re-establish the fistula. After this manoeuver, the assessed IOP remained low. Then 0.1 ml MMC (0.3 mg/ml) solution was injected subconjunctivally (Fig. 1.–5.).

Fig. 1. Subconjunctival injection of 1% lidocaine solution.
Ryc. 1. Podspojówkowe podanie 1% roztworu lignokainy.

Fig. 2. The needle is inserted subconjunctivally towards the fistula, 5–10 mm distal to the bleb.
Ryc. 2. Wprowadzenie końca igły pod spojówkę w kierunku przetoki 5–10 mm ku tyłowi od pęcherzyka filtracyjnego.

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Fig. 3. The needle is guided into the anterior chamber under the scleral flap.
Ryc. 3. Wprowadzenie igły pod płatkiem twardówkowym do przedniej komory.

Fig. 4. Scar tissue removal with sweeping movement technique.
Ryc. 4. Usunięcie zrostów ruchem wymiatającym igły.

After the procedure all patients were administered mydriatic and a combination of Gentamycine and – 0.1% Dexamethasone. All patients were treated with combined steroid and antibiotic eye drops administered four times a day. The treatment was continued during the follow up period and tapered as clinically indicated within several weeks (usually 6–8 weeks).

Fig. 5. Subconjunctival injection of 0.1 ml MMC.
Ryc. 5. Podspojówkowe podanie 0,1 ml MMC.

The patients were examined the next day and subsequent visits were scheduled as needed during the follow-up. At 84 month postoperatively, a routine anterior and posterior segment examination was performed. BCVA, IOP, lens status, the morphology of optic nerve head, the appearance of the bleb and surrounding conjunctival tissue were documented.

Success/ Failure criteria

The success was determined on the basis of IOP alone.

A complete success (S) was considered, if IOP was lower or equal to 18 mmHg without any antiglaucoma medication. Eyes gained qualified success (QS) when IOP was lower or equal to 18 mmHg with a hypotensive medication. Failure (F) was defined as IOP over 18 mmHg with a medication.

Statistical analysis

Data analysis was performed using STATISTICA v. 8.0 (StatSoft, Poland). Statistical significance level of $p \leq 0.05$ was assumed (t-test & Wilcoxon matched paired test).

Results

The mean IOP decreased from 24.5 ± 6.7 mmHg to 15.4 ± 4.4 mmHg, ($p<0.5$) at 12 months (16.8 mmHg – 18 months, 16.5 mmHg – 24 months, 18.4 mmHg – 36 months, 16.3 mmHg – 48.0 months, 16.1 mmHg – 60 months, 17.2 mmHg – 72 months, 16.8 mmHg – 84 months) (Tab. I).

Time after revision (months)/ Czas od rewizji (miesiące)	12	18	24	36	48	60	72	84
Total number of patients/ Całkowita liczba pacjentów	40	32	27	25	18	14	6	4
Success/ Sukces	17 (42.5%)	11 (34.4%)	11 (40.7%)	5 (20%)	3 (16.7%)	5 (35.7%)	1 (16.7%)	1 (25%)
Qualified success/ Częściowy sukces	14 (35.0%)	8 (25%)	8 (29.6%)	6 (24%)	11 (6.61%)	6 (42.9%)	2 (33%)	2 (50%)
Failures/ Niepowodzenie	9 (22.5%)	13 (40.6%)	8 (29.6%)	13 (52%)	2 (22.2%)	3 (21.4%)	3 (50%)	1 (25%)

Tab. I. Mean IOP before and after revision.
Tab. I. Średnie wartości ciśnienia wewnątrzgałkowego przed rewizją i po rewizji.

IOP reduction at 12 months (n = 40) the mean IOP was 15.4 ± 4.4 mmHg (range 6.0–26.0 mmHg) and was significantly reduced compared to the preoperative values (mean 24.5 ± 6.7 mmHg). IOP reduction at 12 months was sustained and statistically significant compared to the preoperative values ($p<0.05$). The success, defined as IOP ≤ 18.0 mmHg without a medication, was achieved in 17 eyes (42.5%). The qualified success, defined as IOP ≤ 18.0 mmHg with an antiglaucoma medication, was achieved in 14 eyes (35.0%). 9 out of 40 eyes (22.5%) were classified as failures. The mean IOP at 24 months (n = 27) was 16.5 ± 4.6 mmHg (range 7.0–24.0 mmHg) ($p<0.05$). The success, defined as IOP ≤ 18.0 mmHg without a medication, was achieved in 11 eyes (40.7%). The qualified success, defined as IOP ≤ 18.0 mmHg with an antiglaucoma medication, was achieved in 8 eyes (29.6%). 8 out of 27 eyes (29.6%) were classified as failures. The mean IOP at 48 months (n = 18) was 16.33 ± 4.2 mmHg (range 10.0–27.0 mmHg) ($p<0.05$).

The success, defined as IOP ≤ 18.0 mmHg without a medication, was achieved in 3 eyes (16.7%). The qualified success, defined as IOP ≤ 18.0 mmHg with an antiglaucoma medication was achieved in 11 eyes (61.1%). 4 out of 18 eyes (22.2%) were classified as failures. The mean IOP at 84 months (n = 4) was 16.75 ± 2.8 mmHg (range 12.0–19.0 mmHg) ($p<0.05$).

The therapeutic success, defined as intraocular pressure ≤ 18 mmHg without medications was achieved in 1 eye (25%). The qualified success, defined as IOP ≤ 18,0 mmHg with an antiglaucoma medication was achieved in 2 eyes (50%). 1 out of 4 eyes (25%) was classified as a failure.

The average interval between the trabeculectomy and MMC-revision was 41.9 ± 53.9 months (range 0.4 – 214.3 months). The length of the interval between the trabeculectomy and revision correlated positively with the initial IOP reduction ($p<0.05$), and lower final IOP level ($p = 0.24$), as compared to the preoperative values. On the other hand, when the patients were subdivided into 2 groups: with early (below 6 months after the surgery) versus late revisions (over 6 months after primary trabeculectomy), no statistically significant difference in the mean IOP was observed (15.8 mmHg vs. 15.1 mmHg, $p = 0.66$) at 12 months.

BCVA

The mean visual acuity, which was Snellen 0.34 ± 0.23 (log Mar 0.48, Americal scale 20/59), did not change significantly at 12 months following the MMC-augmented revision. It was Snellen 0.35 ± 0.25 (logMar 0.46, Americal scale 20/57) with $p = 0.76$. In current study only one patient showed a visual acuity drop over three lines after the revision, due to glaucoma progression. The half-line VA drop was achieved in 1 eye; the 1-line VA drop in 2 eyes; one-line VA improvement was achieved in 1 eye and half-line VA improvement in 2 eyes.

Bleb

The filtering blebs before revision were flat in all eyes. Twelve months after MMC-revision 36 blebs were diffuse and elevated but 4 were flat and difficult to massage (3 of them were assessed as a qualified success and 1 as a complete success).

Lens status

The patients were divided into two subgroups based on the lens status. Twenty-seven eyes were phakic and 13 – pseudophakic. Mean IOP before surgery was 23.2 mmHg in a phakic group and 25.7 mmHg in pseudophakic patients ($p = 0.40$). The mean IOP at 12 months postoperatively was 18.1 mmHg in a phakic group and 13.0 mmHg in pseudophakic patients ($p<0.05$). The percentage IOP reduction compared to baseline was also higher in a pseudophakic group (47.4% vs. 28.1%, respectively; $p<0.05$).

Medications

The mean number of administered medications was reduced from 1.2 ± 0.8 preoperatively to 0.7 ± 0.8 postoperatively ($p<0.05$) at 12 months. The majority of patients (33 eyes, 82%) used medications preoperatively, yet in this group the mean IOP at 12 months postoperatively was lower compared to patients who did not use any medications before the surgery (14.8 mmHg vs. 18.0 mmHg, $p = 0.08$) and the difference was close to statistical significance. Twenty four months after the procedure the mean number of medication was reduced to 0.78 ± 0.49 ($p<0.05$) after a 24 months (n = 27); to 1.83 ± 0.77 ($p>0.05$) after 48 months (n = 18); to 1.25 ± 0.81, ($p>0.05$) after 84 months (n = 4) (Tab. II).

Time after revision (months)/ Czas po rewizji (miesiące)	before	12	18	24	36	48	60	72	84
Number of medications/ Liczba przyjmowanych leków	1.2	0.68	0.81	0.78	1.12	1.83	1.47	1.14	1.25
Number of eyes/ Liczba oczu	40	40	32	27	25	18	14	6	4

Tab. II. The mean number of medications used before and after revision.
Tab. II. Średnia liczba leków przyjmowanych przed rewizją i po rewizji.

Twelve months after the MMC augmented procedure no statistically significant difference in IOP was observed between patients with initial IOP over and under 30 mmHg (15.4 vs. 15.3 mmHg, $p = 0.95$). In the group of patients with the IOP <10.0 mmHg just after the revision, the mean IOP at 12 months postoperatively was 12.5 mmHg, whereas in patients with the IOP>10.0 mmHg immediately after the revision, the mean IOP at 12 months postoperatively was 16.9 mmHg ($p< = 0.05$).

Complications

The complications of MMC revision were observed in 7 of 40 eyes (17.5%). Most of them were early complications which resolved spontaneously within few days. The most common were hyphaema – 5 cases (12.5%) and anterior chamber shallowing – 2 cases (5.0%), hypotony (without choroidal detachment) – 2 cases (5.0%) and conjunctival wound leaks – 1 case (2.5%). These also involved subconjunctival hemorr-

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hage – 3 cases (7.5%) and transient corneal epithelial defects in 2 eyes (5.0%).

Discussion

Filtering procedure failure is a common problem after glaucoma surgery. The clinical options for the patient whose filtration bleb failed are often limited. If medical treatment does not reduce the IOP into an acceptable range, the further surgical intervention is required. Depending on the severity of glaucoma, this may be trabeculectomy at a different site, a glaucoma drainage implant, or a cyclodestructive procedure. A repeated filtrating surgery at a site of conjunctival scarring is usually more difficult and has an increased chance of failure, even with the use of 5-FU or MMC (1, 4, 9). Glaucoma drainage implants may not lower the IOP adequately for severe glaucoma, and have their own set of associated risks and complications (10). Cyclodestructive procedures may be more unpredictable and are thought to be associated with a significant risk of visual loss and phthisis (11).

Revision of failed filtration blebs through a small conjunctival incision was first described in 1941 and the variety of methods have been depicted. However, the principle remains the same, which is to disrupt subconjunctival scar tissue and to restore bleb function with a fairly small degree of surgical trauma to the eye. Revision with adjunctive MMC has become a widely accepted procedure for surgical glaucoma treatment. Numerous authors reported a successful postoperative IOP control with a low rate of complications (4, 12). Our results in terms of the success rate are comparable with other studies, where an absolute success was observed in 39–46% at 1 year (5, 13, 14). Yet, comparison of the results is difficult due to different success criteria assumed in different studies.

The results observed in our study were constant for 24–36 months following the surgery. The success rate was reduced to 50% 36-48 months after the procedure, eventually remaining at a constant level of 20% for the next 36-48 months. Some authors also observed that the success rate did not change in a longer follow-up (14). However, other studies showed that the cumulative success rate of the revision diminished with time to 13–28% at 4 years (13, 15) and concluded that revision seems to be an effective intervention in the short to medium term, but long-term results indicate that additional intervention is necessary in the majority of cases.

In a prospective, randomized study comparing non-augmented revisions and medical treatment after the primary MMC trabeculectomy failure, the revision was successful only in 7.1% of patients. The administration of antimetabolites during the revision helps maintain filtration and the retrospective study which compared the results of a revision with subconjunctival injections of 5-FU (5 mg) versus MMC (0.02 mg) concluded that the probability to obtain the target IOP was higher in patients administered MMC rather than 5-FU (71% vs. 45%, respectively) at 1 year (16) Generally, the MMC-augmented revision appears to be a valuable tool especially in the management of refractory glaucoma (14).

Many risk factors (4) such as uveitis, secondary (i.e. neovascular) glaucoma, exposure to topical sympathomimetics or other antiglaucoma medications, lens status (pseudophakia, aphakia), young age, black race, a fornix-based conjunctival flap, previous surgery involving conjunctival incision and higher initial IOP may cause fibroblastic overstimulation and early or late proliferation of subconjunctival fibrous tissue and scarring, thus reducing the success of the filtration procedure, with or without the bleb collapse (15). The majority of these factors have been reported with little consistency or even contradiction, and a clear picture of which patients benefit from revision is yet to emerge (17).

IOP before revision $>$ 30.0 mmHg and IOP $>$ 10.0 mmHg immediately after this procedure were found to be significant risk factors for the revision procedure failure. Our results visibly support the significance of the low IOP just after the surgery to the outcome. If the physician is able to achieve an IOP of 10.0 mm Hg or less following a revision, the procedure can at least be judged a preliminary success. Such a low IOP indicates that the surgeon was able to re-establish a fistula large enough to restore a significant flow to the subconjunctival space, and the fistula is more likely to remain patent (15). On the other hand, the initial IOP in our study did not allow for a 12 month success prediction.

In our study the influence of the previous cataract surgery on the IOP control was significant but pseudophakia appears not to be a risk factor for revision as it is for trabeculectomy (18). According to our results pseudophakic eyes achieved lower IOP at 12 months following the revision and a larger percentage of IOP reduction from baseline compared to phakic eyes. Perhaps it might be easier to re-establish patent fistula in deep chambers. In contrast, according to Hawkins, pseudophakic or aphakic patients were more likely to fail compared to phakic patients. This tendency is usually the same in primary trabeculectomy and it might be due to previous surgery regardless of lens status, because eyes with a history of surgery tend to be of higher risk compared to unoperated eyes (11). Rotchford assessed the effect of subsequent cataract surgery on trabeculectomy blebs after previous successful revision and concluded that the effect of such bleb revision can be significantly compromised by the subsequent cataract surgery (15).

Initial bleb morphology was identified as a significant determinant of success. Bleb height at the moment of the revision procedure strongly predicted survival, but this effect was restricted to blebs that were needled within the first 3-months after trabeculectomy, to highly vascularized blebs, and to microcystic blebs (15). In our study the bleb morphology was used for choosing the surgical technique. All patients had flat scarred blebs, therefore the procedure described above was chosen, which made it possible to obtain functioning elevated blebs in most cases. It has generally been accepted that in patients with encapsulated blebs a better response may be ensured by using more prompt needling procedure augmented with MMC (5).

We found a revision with MMC to be sufficiently safe and effective option for regaining IOP control for up to 24–36 months following the procedure. Nevertheless, this simplicity may be misleading. Possible complications of trabeculectomy may also develop after revision procedure. The most common complication is bleeding into the bleb. The extensive intrableb hemorrhage is a poor prognostic sign for success of revision.

Topical corticosteroid may be helpful to resolve this problem (12). A short–term hypotony (1–2 weeks) has been reported as a common and self-limited problem. Patients should be warned to avoid activities resulting in Valsalva maneuver. The type and rate of complications observed in our study was similar to the ones described by different authors (13, 14). Most of them were early complications which resolved spontaneously within few days.

Feldman and Tabet (12) reported failure of filtration as the most common complication. Sometimes more than one revision procedure may be required in a significant proportion of patients and even then the management may be unsuccessful in some cases (9). Blebs undergoing more than one revision have a much poorer prognosis than those undergoing only one. It is not surprising the success is less likely with each failed attempt (5, 17, 19). In our study patients with multiple revisions were excluded.

The AGIS Investigators (20, 21) demonstrated a small postoperative mean visual acuity decline resulting from the attempts to reduce IOP medically, surgically or by laser, which was due to the accelerated cataract formation, age-related macular degeneration or glaucoma progression despite a very good IOP control (4). In current study only one patient showed a visual acuity drop greater than three lines after the revision, due to glaucoma progression.

Another factor of potential importance is the interval between the initial surgery and revision of this filtration site. In some reports, the revision was performed within a 6-week postoperative period (22) whereas others reported the interval of a few years in some proportion of the cases (23, 24). Surgical revision (rather than needling) has been reported to be less successful in eyes with bleb failure occurring shortly after the initial surgery, as opposed to eyes with bleb failure occurring long after the initial surgery (17). Feldman recommended that revision be considered before a more aggressive surgical intervention or before additional medical therapy (12). Other authors advocate revisions for functioning blebs, which do not adequately lower the IOP. A short interval between the initial surgery and revision was associated with success (25), which was not confirmed in our study. We found that outcomes were better when the revision was performed on 'still functioning' blebs but the length of the interval between the trabeculectomy and revision correlated positively with thereduction of initial IOP and lower final IOP level. It might stem from the fact the late revision is usually performed on the eye without inflammation and scaring which are marked during the acute postoperative period following the primary trabeculectomy and can be avoided thanks to late revisions. According to Feldman, best results can be expected in eyes with functional blebs requiring IOP lowering. These are the most common after more than a year following the initial surgery (12).

Topical antiglaucoma medications may lead to ocular surface disorders, as they contain preservatives (26). The successful revision after trabeculectomy may even contribute to a better quality of life in patients experiencing adverse effects of topical medications.

Taken together, MMC-revision appears to be a useful tool in glaucoma management. It is a safe, straightforward procedure which restores the filtering function in a good proportion of cases and minimizes intraocular dissection, thus preserving precious conjunctiva. Revision is a safe procedure although its effect is relatively short term.

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