

Surgical Repair of Leaking Filtering Blebs Using Two Different Techniques

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Purpose: To report the outcomes of two different surgical techniques for the repair of late onset bleb leakage following trabeculectomy.

Methods: This retrospective study includes 21 eyes of 20 patients with prior trabeculectomy and late-onset bleb leaks; 14 eyes underwent excision of the filtering bleb together with conjunctival advancement while in the other 7 eyes the bleb was retained but de-epithelialized before conjunctival advancement. Success was defined as resolution of leakage with no need for additional glaucoma surgery together with intraocular pressure (IOP) of 5-21 mmHg. Complete and qualified success was considered when the above mentioned was achieved without or with glaucoma medications, respectively.

Results: Mean duration of follow-up was 20.3±14.4 months. No significant difference was observed between the two groups in terms of complete, qualified and overall success rates ($P>0.05$), however more antiglaucoma medications were necessary in the bleb excision group ($P=0.02$).

Conclusions: Both surgical techniques of bleb repair were comparably effective, however the bleb de-epithelialization technique was associated with less need for glaucoma medications after the procedure.

Keywords: Bleb Leakage; Bleb Repair; Conjunctival Advancement; Trabeculectomy

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INTRODUCTION

Leakage of aqueous humor from the conjunctival filtration bleb is a common complication of trabeculectomy. It is a serious and vision-threatening condition that may occur days (early-onset) or months to years (late-onset) after the initial surgery. Complications of leaking blebs include hypotony, blebitis and endophthalmitis. With the advent of antifibrotic agents, the incidence of bleb leaks has increased¹⁻⁵ and is higher in blebs with a large avascular area.⁵⁻⁶

Although conservative treatment with

medical agents or using a variety of mechanical methods may be tried first,⁷⁻¹⁰ definitive treatment for late onset bleb leaks often requires surgical repair. Numerous surgical techniques have been described in the literature such as bleb excision with conjunctival advancement,¹¹⁻¹⁴ bleb reconstruction with a rotational conjunctival flap,¹⁴ bleb preservation with conjunctival advancement or placement of an autologous conjunctival graft,¹⁵ use of a donor scleral patch,¹⁶ and amniotic membrane transplantation¹⁷⁻¹⁸. Surgery is more successful in eliminating bleb leakage as compared to conservative treatment¹⁹

and tailoring the choice of surgical technique to the clinical situation may improve success.²⁰

This study reports the outcomes of bleb repair for late-onset leaks following trabeculectomy with or without antifibrotic agents using two different surgical techniques: bleb excision or bleb de-epithelialization with conjunctival advancement.

METHODS

A retrospective chart review was performed on medical records of all patients who had undergone bleb repair surgery for late onset leakage between September 2002 and May 2008, at Wills Eye Institute, Philadelphia, USA. Variables included demographic characteristics, type of glaucoma, type of filtering procedure, type of antifibrotic agent used (if applicable), pre- and post-operative (day 1, week 1, month 1 and final visit) intraocular pressure (IOP), pre- and post-operative best corrected visual acuity (BCVA), time interval between initial surgery and bleb repair, type of repair procedure, perioperative complications, number of antiglaucoma medications, and number and type of additional operations.

All patients had previously undergone trabeculectomy (with or without antifibrotic agents) and had developed a leaking bleb. Patients who had surgical revision for early-onset bleb leaks (i.e. those occurring less than one month following trabeculectomy), or for hypotony without leakage were excluded. The two most commonly used surgical techniques are described below.

Bleb Excision and Conjunctival Advancement

In this group, after placing a superior corneal traction suture or a superior rectus bridle suture, a paracentesis was performed and a conjunctival peritomy was made for 90–120 degrees centered superiorly. The previous bleb was then excised down to bare sclera and aqueous flow through the sclerostomy site was assessed with a cellulose surgical sponge. If excessive leakage was present, the scleral flap would be sutured with additional interrupted 10/0 nylon sutures or reinforced with processed human pericardium graft (Tutoplast™) over the site of leakage (patients # 6 & 13, Table 1). Adjacent conjunctival tissue was then advanced after careful posterior blunt dissection from underlying Tenon’s capsule and

Table 1. Clinical data of patients undergoing bleb excision and conjunctival advancement (Group 1)

Patient number	Age (year)	Diagnosis	Prior antimetabolite exposure	Additional surgical intervention	Pre-op IOP (mmHg)	Last visit IOP (mmHg)	Post-op antiglaucoma medications	Pre-op vision (LogMAR)	Post-op vision (LogMAR)	Follow-up (months)
1	70	POAG (OD)	-		2	14	2	0.3	0.4	3
		POAG (OS)	MMC		1	15	2	1	0.4	13
2	60	POAG	-		10	16	4	0.5	0.4	39
3	52	POAG	-		10	16	0	0.3	1	10
4	28	POAG	-		11	20	4	0.1	0.2	16
5	85	POAG	-		12	10	0	0.3	0.3	23
6	79	POAG	-	Pericardium graft Bleb revision for leakage	3	19	2	0	0.1	29
7	52	POAG	-		12	16	2	NA	NA	6
8	63	POAG	MMC		5	12	3	0.3	0.3	23
9	40	POAG	MMC		6	5	0	0.2	0.3	16
10	81	NTG	MMC		6	17	2	0.55	1	53
11	68	NTG	MMC		15	12	1	0.4	1.3	2
12	72	Chandler’s syndrome	MMC	Pericardium graft	20	21	1	0.55	1.3	20
13	36	POAG	5-FU	Bleb revision for leakage	11	13	2	0.1	0	37

POAG, primary open angle glaucoma; OD, right eye; OS, left eye; NTG, normal-tension glaucoma; MMC, mitomycin C; 5-FU, 5-Fluorouracil; pre-op, preoperative; post-op, postoperative; IOP, intraocular pressure; LogMAR, logarithm of minimum angle of resolution

tightly secured at the limbus with 10/0 nylon or 8/0 vicryl sutures.

Bleb Retention and De-epithelialization with Conjunctival Advancement

After placement of a superior corneal traction suture or a superior rectus bridle suture, a paracentesis was made. A conjunctival peritomy was performed superiorly for 90–120 degrees around the existing bleb. Blunt dissection was then performed in the subconjunctival plane around the bleb to ensure that adequate conjunctiva had been mobilized. Cautery and a 67-blade were then used to de-epithelialize the surface of the existing filtering bleb and the edge of the limbus. In three cases, a surgical blade was used to incise the posterior aspect of the bleb to redirect aqueous flow posteriorly. The conjunctiva was finally advanced over the existing bleb and anchored to the limbus with 10/0 nylon or 8/0 vicryl sutures.

At the end of surgery in both groups, the anterior chamber was formed using balanced salt solution. The choice between different types of procedures was influenced by the surgeons’ personal experience rather than specific bleb characteristics.

Successful repair of the leaking bleb was defined as resolution of leakage with no need for additional surgery, together with maintaining IOP in the range of 5-21 mmHg without (complete success) or with (qualified success) antiglaucoma

medications. Overall success was defined as the sum of complete and qualified success. Failure was defined as any surgical intervention after bleb repair including resuturing for leakage, bleb revision with 5-fluorouracil injection or glaucoma surgery.

Statistical analysis was performed using SPSS for windows, version 11.5 (SPSS Inc., Chicago, IL, USA). For comparing mean values, we used Wilcoxon signed rank test for within group evaluations, and Mann-Whitney *U* test for between group evaluations. For comparing categorical data, chi-square or Fisher exact test were used; significance was set at 0.05.

RESULTS

Overall, 21 eyes of 20 patients with mean age of 60.8±15.2 (range, 28-85) years including 14 female and 6 male subjects were studied; the bleb excision group (group 1) included 14 eyes (66.7%) and the bleb retention group (group 2) consisted of 7 eyes (33.3%). The diagnoses prior to filtering surgery as well as patients’ demographics and characteristics are shown in Tables 1 and 2. Bleb repair was preceded by trabeculectomy with an antifibrotic agent in 11 cases (52.4 %) including mitomycin C (MMC) in 10 and 5-fluorouracil (5-FU) in one eye, and trabeculectomy without the use of any antifibrotic agent in 10 eyes (47.6%). Simultaneous cataract extraction had been performed in one eye in each of the subgroups undergoing trabeculectomy

Table 2. Clinical data of patients undergoing bleb de-epithelialization and conjunctival advancement (Group2)

Patient number	Age (years)	Diagnosis	Prior antimetabolite exposure	Additional surgical intervention	Pre-op IOP	Last visit IOP	Post-op antiglaucoma medications	Pre-op vision (LogMAR)	Post-op vision (LogMAR)	Follow-up (months)
1	64	PG	-		8	13	1	0.2	0.3	3
2*	63	POAG	-	Bleb revision for leakage	2	10	0	0	0	22
3	59	POAG	-		10	13	1	0.1	0.2	4
4	60	POAG	MMC		4	12	0	0.2	0.3	19
5*	61	POAG	MMC	Bleb needling+5-FU injection	3	15	0	1.3	1.9	30
6	39	Uveitic glaucoma	MMC		14	19	1	2.8	2.8	46
7*	75	POAG	MMC	Ahmed valve implantation	9	21	0	1.3	1.9	14

PG, pigmentary glaucoma; POAG, primary open angle glaucoma; MMC, mitomycin C; 5-FU, 5-fluorouracil; pre-op, preoperative post-op, postoperative; IOP, intraocular pressure; LogMAR, logarithm of minimum angle of resolution

*An incision was made in the posterior aspect of the bleb to redirect aqueous flow posteriorly

with and without antifibrotic agents.

Mean follow-up period was 20.3±14.4 (range, 2-53) months. Success was achieved in 16 cases (76.2%) overall, 3 cases (14.3%) required a second bleb revision due to recurrent bleb leaks and two eyes (9.5%) needed additional glaucoma surgery.

Mean IOP was 8.2±4.4 mmHg preoperatively and 14.7±4.1 mmHg at final visit (P=0.0001) using 0.45±0.68 and 1.2±1.27 antiglaucoma agents, respectively (P=0.02); the patients had been on medications to control glaucoma before developing a bleb leakage but following repair they required more drops. Mean BCVA was 0.49±0.69 LogMAR preoperatively and 0.63±0.66 at final visit (P=0.24). One eye (4.7%) had a transient IOP spike of 42 mmHg on the first postoperative day in group 1. No case of shallow anterior chamber, choroidal effusion, suprachoroidal hemorrhage, ptosis or diplopia was noted.

Group Analysis

Group 1 consisted of 14 eyes of 13 patients including 8 female subjects while group 2 was comprised of 7 eyes of 7 patients including 6 female patients (P=0.33). Mean age was 61.4±14.3 years in group 1 and 60.1±10.7 years in group 2 (P=0.6). The time interval between trabeculectomy and bleb leakage was 57.6±48.1 months in group 1 and 57.2±43.3 months in group 2 (P=0.8). Mean follow-up after bleb repair was 20.7±14.7 and 19.7±15.1 months in groups 1 and 2, respectively (P=0.91). There was no statistically significant difference between groups 1 and 2 in terms of preoperative IOP (8.8±5.3 versus 7.1±4.3 mmHg, P=0.41) or IOP at final visit (14.7±4.3 versus 14.7±3.9 mmHg, P=0.73). Mean preoperative IOP values as well as postoperative IOP on day 1, and at week 1, month 1 and final follow-up are detailed in Figure 1.

The number of antiglaucoma medications at the last visit was 1.7±1.3 in group 1 and 0.42±0.5 in group 2 (P=0.02). One eye (7.1%) in group 1 had IOP of 5 mmHg at final visit; this was a patient who had low-tension glaucoma and did not have symptomatic hypotony.

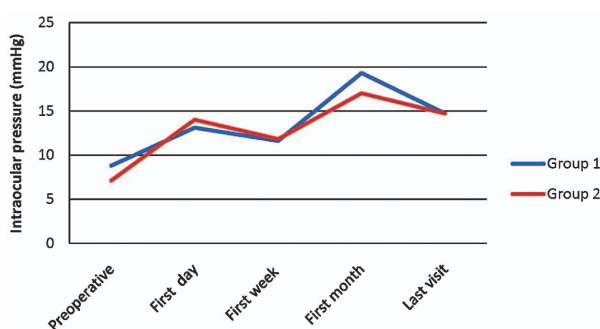


Figure 1. Mean intraocular pressure at baseline and various postoperative visits in groups 1 (bleb excision with conjunctival advancement, 14 eyes) and 2 (bleb de-epithelialization with conjunctival advancement, 7 eyes).

Kaplan-Meier analysis of probability for overall success in the study groups is shown in Figure 2. The probability of overall success at the end of the first postoperative year was 92.8% in group 1 and 62.5% in group 2 (P=0.19), corresponding figures at the end of the second year were 82.5% and 62.5%, (P=0.42). The probability of complete and qualified success at the end of the first year were 71.4% and 21.4% in group 1, respectively which were comparable to group 2 (42.8% and 19.7%, respectively; P=0.21). At the end of the second year, 23.8% of eyes in group 1 and 42.8% of those in group 2 achieved complete success (P=0.88) and the rate of qualified success was 58.7% and 19.7%, respectively (P=0.4). More antiglaucoma medications were required in group 1 (P=0.025).

Mean interval between filtering surgery

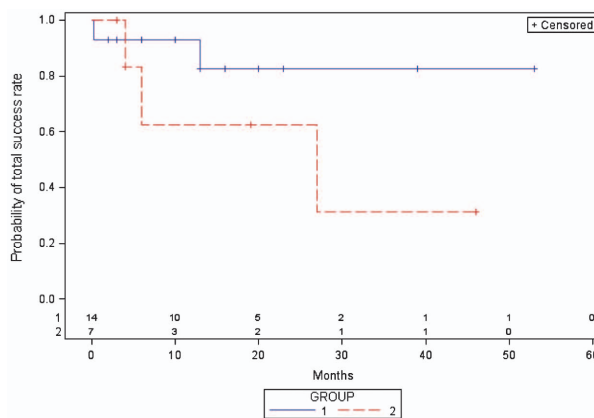


Figure 2. Kaplan-Meier analysis of cumulative probability of success in group 1 (bleb excision and conjunctival advancement, 14) and group 2 (bleb de-epithelialization and conjunctival advancement, 7).

and bleb repair was 57.4 ± 44.9 (range, 13.5-174) months overall, and 50 ± 30.6 (range, 13.5-101) months in the subgroup that had trabeculectomy with an antifibrotic agent versus 71.7 ± 67.7 (range, 16.5-174) months in the subgroup that had trabeculectomy without an antifibrotic agent ($P=0.66$). No significant difference ($P=0.79$) was observed in terms of overall success between eyes that had undergone trabeculectomy with an antifibrotic agent (8 out of 11, 72.7%) and those that had trabeculectomy without an antifibrotic agent (8 out of 10, 80%). Complete and qualified success was achieved in 2 (20%) and 6 (60%) eyes that had not received antifibrotic agents; an identical number of eyes which had received an antifibrotic agent achieved complete (2, 18.1%) and qualified success (6, 54.5%), ($P=0.69$).

DISCUSSION

Bleb leakage may occur any time following trabeculectomy with or without the use of antifibrotic agents. Early leaks are generally due to wound leakage or buttonholes in the conjunctiva during the surgical procedure. Late leaks are usually spontaneous and associated with a thin, avascular bleb.²¹ The incidence of this type of blebs has increased considerably since the adjunctive use of antifibrotic agents has become more popular in glaucoma filtering procedures. The frequency of late-onset bleb leaks in these patients can be as high as 10% with an incidence of 3.3% per year.^{1,22} The Fluorouracil Filtering Surgery Study Group demonstrated the 5-year incidence of bleb leaks to be 9% in eyes receiving 5-FU and 2% in those receiving no antimetabolite.²³

Anand and colleagues² studied 125 eyes undergoing MMC-augmented glaucoma surgery (trabeculectomy, deep sclerectomy and combined procedures) and reported a probability of developing transconjunctival oozing in 95% and bleb leaks in 26% of eyes with avascular blebs. In our series of 21 eyes with late-onset bleb leakage following trabeculectomy, 11 (52.3%) had intraoperative use of an antifibrotic agent. Mean interval between trabeculectomy and bleb repair was approximately 57.4 months. The time to revision was shorter in the group with

antifibrotic agent usage, however, the difference was not statistically significant ($P=0.66$) which may be due to small sample size.

IOP was between 6 and 21 mmHg in 95% of the eyes at final follow-up which was achieved without any medications in 7 eyes (33.3%). No statistically significant difference was observed between the two surgical techniques in terms of success rate, although there was a trend towards a higher success rate in the bleb excision group; the rate of complete success was greater in this group (42.8% vs. 23.8%) at the end of the second year but at the expense of using more antiglaucoma medications ($P=0.02$). No statistically significant differences were observed regarding final IOP. Along with de-epithelialization of the bleb and conjunctival advancement, three patients had additional incisions in the posterior wall of the bleb; this was intended to redirect aqueous flow posteriorly in order to create a larger and more diffuse bleb that would be less likely to leak.

Table 3 summarizes the results of previous reports on surgical treatment for late-onset bleb leakage. Success rates vary from 47 to 100% depending on the surgical technique and success criteria. Some authors have performed bleb de-epithelialization with some variation in technique; in the reports by Catoira et al²⁴ and Burnstein et al¹⁹ a blunt blade and wetfield cautery were used to de-epithelialize the bleb (similar to our technique) whereas Harris et al¹⁵ used absolute alcohol for this purpose. Their techniques were also different regarding the type of conjunctiva they used to cover the bleb. In the first two reports the surgeons advanced the conjunctiva adjacent to the bleb while in the latter study the authors used a free autograft from the inferotemporal conjunctiva. Harris et al¹⁵ used similar success criteria as we did and reported a success rate of 91.5%, which is higher than the 62.5% observed in our series. This may be due to different surgical techniques and/or different follow-up periods. Sample size in the previous reports varied from 30 to 47 patients which were larger than ours.

Al-Shahwan et al¹² performed bleb excision with conjunctival advancement using a technique similar to ours in 34 patients with late-onset bleb leakage. After a mean follow-up of 36.2

Table 3. Previous reports on treatment of late-onset bleb leaks

Study	Design	Number of cases	Technique	Success rate	Success criteria	Mean follow-up (months)
Catoira, et al ²⁴	Retrospective, non-comparative case series	17	Bleb de-epithelialization with conj. advancement	47%	Resolution of leak with IOP ≥ 6 and ≤ 21 mmHg without meds	15.6
Harris et al ¹⁵	Retrospective, non-comparative case series	47	Bleb de-epithelialization with conj. autograft	91.5%	No recurrences later than 1 month after surgery and no further surgical intervention for glaucoma, with adequate IOP	14
Wadhvani et al ²⁰	Retrospective, non-comparative case series	22	Pedicle flap with bleb preservation, bleb excision with conj. advancement, bleb excision with free conj. autograft	86%	IOP control with ≤ 2 meds after one or more bleb revisions	21
Burnstein et al ¹⁹	Retrospective, non-randomized comparative interventional trial	34	Bleb de-epithelialization with conj. advancement	79.4%	Resolution of leak, IOP ≤ 21 mmHg and no significant complications	22.9
Al-Shahwan et al ¹²	Retrospective, non-comparative case series	34	Bleb excision, conj. advancement	58.8%	IOP ≤ 21 mmHg without meds	36.2
Rauscher et al ¹⁷	Randomized, controlled trial	15	Bleb excision, conj. advancement	73.3%	No additional surgery needed (glaucoma or bleb revision) and controlled IOP	79*
		15	Bleb excision, AMT	53.3%		80*
Nagai-Kusuhara et al ¹⁸	Retrospective, non-comparative case series	6	AMT-assisted bleb revision	100%	Resolution of leak with adequate IOP	49*

* median; conj., conjunctiva; IOP, intraocular pressure; AMT, amniotic membrane transplantation

months, they reported a success rate of 58.8%. At 22 months, qualified success (successful repair with IOP ≤ 21 mmHg using ≤ 2 medications) was 72%, which exceeds our success rate of 58.7%. The authors stressed the importance of follow-up duration for measuring success; at 5 years, their qualified success rate dropped to 15% showing that late bleb failure can occur on a long term basis. In the current study, complete success rate at the end of the second year (23.8%) was decreased relative to the first year (71.43%) but this value did not change in group 2 (42.86%). This may be explained by making additional incisions in the posterior wall of the bleb in 3 eyes of group 2 and also less trauma to the bleb and consequently less inflammation and fibrosis with the de-epithelialization technique.

Rauscher et al¹⁷ reported the long-term results of a randomized controlled trial that compared bleb excision followed by either amniotic membrane transplantation (AMT) or conjunctival advancement for repair of late-

onset bleb leakage. After one-year, more cases of recurrent leak and bleb failure were noted with AMT, therefore the trial was halted after recruitment of 30 subjects.³⁵ Their long-term results (with median follow-up of 80 months) also showed higher success rate in the conjunctival advancement group (73%) as compared to the AMT group (53%), but this difference was not statistically significant. Nagai-Kusuhara et al¹⁸ reported 100% success rate in their retrospective case series of 6 patients submitted to AMT-assisted bleb revision for late-onset bleb leakage. Improvement in surgical technique may account for better outcomes with this method of bleb repair and this technique may still prove to be suitable, especially when the conjunctiva is insufficient for advancement.

Table 3 shows that regardless of the technique of bleb revision, success rates vary considerably. In reviewing the literature, there was no consistent evidence of improved success with either bleb excision or bleb de-

epithelialization for late-onset bleb leaks. Our study showed similar results; although bleb excision showed a higher success rate at the end of the second year (82.5% vs. 62.5%), the difference was not statistically significant and more medications were used. No major intraoperative complications were encountered in our series.

Limitations of the current study include small sample size, multiple surgeons and possibly inter-surgeon variations in details of surgery. A larger sample size will require a multicenter collaborative effort.

Late-onset bleb leakage is a vision threatening complication of glaucoma filtering procedures that usually requires surgical repair. Our study demonstrates that excision of the preexisting filtering bleb or bleb retention with surface de-epithelialization and conjunctival advancement are effective in controlling bleb leakage but at the expense of more antiglaucoma medications with the bleb excision method. Considering the limitations of this study including its retrospective nature and small sample size, further studies with higher number of participants are necessary to draw a firm conclusion.

Conflicts of Interest

None.

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