

Comparison of incidence of ptosis after combined phacotrabeculectomy with mitomycin C and phacoemulsification

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Objective: To compare the incidence of upper eyelid blepharoptosis after combined phacotrabeculectomy with mitomycin C and phacoemulsification surgeries and the relationship of bleb morphology to the incidence of ptosis. **Design:** Retrospective observation study. **Participants:** We included 46 patients after combined phacotrabeculectomy and 44 patients with phacoemulsification in the former group, and all eyes underwent a standardized two-site surgery with intra-operative mitomycin C. **Materials and Methods:** Postoperative ptosis was defined as a reduction of upper marginal reflex distance 2 mm in the operated eye compared to the fellow eye. Trabeculectomy bleb measurements were carried out using anterior segment optical coherence tomography (VisanteTM, Carl Zeiss Meditec, Dublin, CA, USA) which included bleb height and total area of the bleb. **Results:** There were 8 eyes (17.4%) and 5 eyes (11.4%) with postoperative ptosis in the phacotrabeculectomy and phacoemulsification groups, respectively ($P = 0.342$). In multivariate regression analysis, reduced total bleb area was significantly associated with upper eyelid ptosis after adjusting for age, gender, and type of anesthesia. The trend seemed to show that increased bleb height was also associated with ptosis, but this did not reach statistical significance. **Conclusions:** Incidence of persistent ptosis after phacoemulsification combined with trabeculectomy and mitomycin C is similar compared to stand alone phacoemulsification surgery in a multiethnic Asian population. Bleb morphology may play an important role in postoperative ptosis development and should be considered in the evaluation of upper eyelid blepharoptosis.

Key words: Combined phacotrabeculectomy, phacoemulsification, postsurgery, ptosis

Phacoemulsification is the most common intraocular surgery performed and can be combined with glaucoma filtration surgery if both cataract and glaucoma are concomitantly significant. The incidence of ptosis after cataract surgery alone has been reported to be between 5% and 20%.^[1-3] Postoperative ptosis can be classified into transient or persistent and is mostly traumatic in nature. The true incidence of postoperative ptosis could be underestimated because a substantial proportion of postoperative ptosis resolves after 6 months and only around 18% of patients noticed a change in their upper eyelid position after cataract surgery.^[3] However, the incidence of ptosis after combined phacotrabeculectomy with mitomycin C is not known in Asian eyes. The risk of postoperative ptosis was shown to be associated with several risk factors such as longer surgery resulting in prolonged eyelid compression from lid speculum, prolonged eyelid edema from periocular inflammation, and foreign body reaction from conjunctival sutures.^[3-5] Many of these risk factors are associated with combined phacotrabeculectomy with mitomycin C. It is also unclear if trabeculectomy bleb morphology under the upper eyelid may play a role in postoperative ptosis.

We aimed to determine the incidence of upper eyelid blepharoptosis in patients after combined phacotrabeculectomy and mitomycin C and compared it with patients undergoing

only phacoemulsification. We also aimed to determine the relationship between bleb morphology and the incidence of ptosis.

Materials and Methods

This is a retrospective observational study comprising patients who had either phacoemulsification surgery or combined phacotrabeculectomy with mitomycin C surgery, recruited from the ophthalmology clinics at the National University Hospital, Singapore between October 2006 and September 2007. Informed consent was obtained from all patients before eyelid measurement was evaluated. The study was conducted in accordance with the tenets of the World Medical Association's Declaration of Helsinki and had ethics approval from the National Healthcare Group Domain Specific Review Board. We excluded patients who had a history of periorbital trauma or prior ocular surgery.

Patients included in the combined phacotrabeculectomy group underwent standardized two-site surgery under either regional or general anesthesia. Conjunctival flaps were either limbal or fornix-based and mitomycin C (0.4 mg/1 ml)

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soaked sponges were applied under the conjunctiva for 3–4 min. Conjunctival flaps were closed with 2–4 10-0 nylon sutures to ensure a water-tight wound closure. Patients in the phacoemulsification group underwent uncomplicated surgery under peribulbar block and monitored sedation. For both groups of patients, the surgeon was seated at the head end of the patient using a “superior” intraocular approach and a self-retaining libermann eyelid speculum was used to keep the eyelids open during the surgery. All the eyes had clear cornea incisions, and none of the eyes had superior rectus bridle suture or experienced intra-operative complications. After surgery, both groups of patients received a combination of topical antibiotics and steroids for at least 6 weeks duration.

Postoperative marginal reflex distance-1 (MRD-1) was assessed at least 6 months after surgery by a single trained ophthalmology resident (JT) after ensuring the patient after full frontalis muscle relaxation. MRD-1 was measured for both eyes under standardized bright illumination with the patient looking in primary gaze at a light source. MRD-1 was defined as the vertical distance between the upper eyelid margin and the corneal reflex measured in millimeters. Ptosis was defined as a reduction of MRD-1 of more than or equal to 2 mm in the operated eye compared to the fellow eye. Vertical palpebral aperture was defined as the distance between the upper and lower eyelid margin at the axis of the pupil when the eye is in the primary position. With brow fixation, levator palpebrae superioris function was measured as the amount of upper lid margin elevation between looking down, and then looking as up as far as possible. We have only included patients who had unilateral eye surgery at the point of eyelid measurement for the final analysis. Bleb measurements of patients who underwent combined phacotrabeculectomy were taken 6 months postoperatively using anterior segment optical coherence tomography (AS-OCT) (VisanteTM, Carl Zeiss Meditec, Dublin, CA, USA) which includes bleb height and total area of the bleb measurements. The details of bleb measurement have been previously reported and published.^[6] In brief, the participant was asked to look down, and the upper lid gently retracted to expose the bleb as fully as possible. Standard AS-OCT images were obtained for each bleb including a radial section perpendicular to the limbus and a section tangential to the limbus, both through the site of maximal bleb elevation. The total height of the bleb was compared to scleral thickness and classified into high blebs (total bleb height [TH] exceeding twice scleral thickness [S]), moderate height blebs ($S < TH < 2S$), and low blebs ($TH < S$). Total bleb area was obtained manually from both radial and tangential scans of the bleb by measuring the maximal extent of the hyporeflexive sub-conjunctival spaces. Fig. 1 shows an example of a functioning trabeculectomy bleb and the corresponding AS-OCT image in a patient with left-sided postoperative upper eyelid blepharoptosis.

Statistical analysis

All analyses were performed using SPSS version 20 (IBM Corporation, Armonk, NY, USA). Mean with standard deviation was calculated for continuous variables and frequency with percentage (%) was tabulated for categorical variables. Differences in means were assessed using either Student's *t*-test or one-way analysis of variance, and associations between categorical variables and cohort studies were assessed using Chi-squared test. Binary logistic regression analysis model was

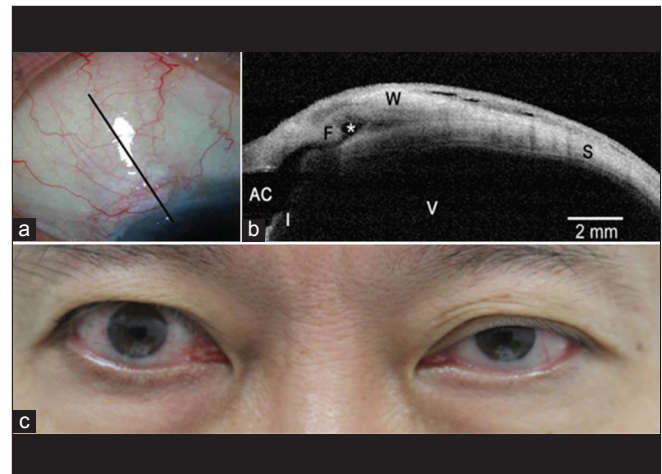


Figure 1: (a) Clinical photograph of a trabeculectomy-bleb. (b) Standardized anterior segment optical coherence tomography image of the same trabeculectomy bleb (W: Bleb wall; S: Sclera; V: Vitreous cavity; I: Iris; F: Flap; *: Cavity). (c) Clinical photograph of the patient with unilateral left-sided upper lid blepharoptosis after combined phaco-trabeculectomy with Mitomycin C

used to determine the association between bleb measurements and upper eyelid ptosis.

Results

In total, we included 46 patients in the phacotrabeculectomy group and 44 patients in the phacoemulsification group, and eyelid measurements were taken between 6 and 11 months after surgery. Table 1 compares the characteristics between the two groups of eyes and there was no significant difference in the age, ethnicity and type of anesthesia. There was significantly more females in the phacoemulsification group compared to the phacotrabeculectomy group. There were four patients who elected to have their combined phacotrabeculectomy surgery performed under general anesthesia. There were eight eyes (17.4%) and five eyes (11.4%) with postoperative ptosis in the phacotrabeculectomy and phacoemulsification groups, respectively ($P = 0.342$). Compared to the fellow eye [Table 2], the operated eyes had significantly smaller postoperative MRD-1 and reduced levator palpebrae superioris function. Compared to eyes with phacoemulsification alone, eyes with phacotrabeculectomy and mitomycin C had significantly smaller vertical palpebral aperture and weaker upper eyelid levator function. However, there is no difference in the MRD-1 measurements between the eyes with phacoemulsification and phacotrabeculectomy with mitomycin C.

Among phacotrabeculectomy group, 44 (95.7%) eyes had fornix-based conjunctival flaps, and 2 (4.3%) had limbal-based conjunctival flaps. The mean bleb height was 1.38 ± 0.50 mm and 1.69 ± 0.39 mm for eyes without ptosis and with ptosis, respectively ($P = 0.064$). Similarly, the mean total bleb area was 5.94 ± 2.40 mm² and 4.67 ± 1.36 mm² for eyes without ptosis and with ptosis ($P = 0.057$). Table 3 shows multivariate analysis to determine the relationship between trabeculectomy bleb morphology with ptosis. Reduced total bleb area was significantly associated with upper eyelid ptosis after adjusting for age, gender and type of anesthesia. It also showed a trend

Table 1: Comparison of patients in the phacoemulsification and phaco-trabeculectomy with Mitomycin C group

	Phacoemulsification (n=44)	Phaco-trabeculectomy (n=46)	P value*
Age (years) [†]	69.1±8.0	66.5±9.4	0.16
Female gender (%)	31 (70.5)	16 (34.8)	0.001
Ethnicity (%)			
Chinese	33 (75.0)	37 (80.4)	0.73
Malay	5 (11.4)	5 (10.9)	
Indian	5 (11.4)	4 (8.7)	
Type of anaesthesia			
Peribulbar	44 (100)	42 (91.3)	0.117
General	0	4 (8.7)	
Number of upper lid ptosis (%)	6 (13.6%)	8 (17.4)	0.422

*Students T-test or one-way ANOVA for continuous variables and Chi-square test for proportions. [†]Data presented as mean±standard deviation for continuous variables

Table 2: Comparing eyelid measurements[†] between operated eyes and fellow eyes; and between eyes with phacoemulsification only and phaco-trabeculectomy with Mitomycin C

	Vertical palpebral aperture (mm)	Marginal-reflex distance-1 (mm)	Levator palpebrae superioris function (mm)
Operated eye	6.43±1.65	2.09±1.15	12.33±2.26
Fellow eye	6.87±1.83	2.50±1.11	12.69±2.26
P value*	0.003	0.001	0.008
Phacoemulsification	6.83±1.65	2.23±0.91	12.84±2.16
Phaco-trabeculectomy with Mitomycin C	6.02±1.56	1.96±1.33	11.85±2.27
P value*	0.02	0.27	0.036

*Students T-test. [†]Data presented as mean±standard deviation for continuous variables

suggesting an association between increased bleb height and ptosis, but this did not reach statistical significance.

Discussion

Eyelid malposition after AS surgery is well-reported including entropion, ectropion, or much more commonly upper eyelid ptosis. The true incidence of postoperative ptosis is debatable and seems to depend on the type of AS surgery, surgical and anaesthetic approach.^[7-9] In addition, a substantial proportion of postoperative ptosis improves over 3–6 months after surgery, and this was the main reason our study evaluated the patients for persistent ptosis at least 6 months after surgery.^[3] Song *et al.* showed that comparing trabeculectomy alone (150 eyes) and when combined with cataract surgery (236 eyes), the incidence of ptosis was not significantly higher, that is, 10.7% and 12.7%, respectively. Compared to local anesthesia, studies have shown that surgery performed under general anesthesia is at a lower risk of developing postoperative ptosis.^[7,8] However, Ropo *et al.*^[10] showed no difference in the incidence of ptosis for cataract

Table 3: Association between bleb morphology with upper eyelid ptosis in eyes after phaco-trabeculectomy with Mitomycin C

	Presence of upper eyelid ptosis in phaco-trabeculectomy group (n=46)	
	OR (95% CI)*	P value
Age (years)	0.98 (0.87,1.09)	0.66
Gender		
Female	Reference	
Male	0.23 (0.02,2.34)	0.23
Bleb height (mm)	5.52 (0.85,25.81)	0.082
Total bleb area (mm ²)	0.61 (0.43,0.95)	0.030
Type of anaesthesia		
Peribulbar	Reference	
General	1.86 (0.12,27.83)	0.65

*Binary logistic regression analysis adjusted for age, gender, bleb area, bleb height, type of anaesthesia and type of conjunctival flap (fornix or limbal-based approach)

surgery done with either anesthetic approach. This seems to suggest that the cause of postoperative ptosis is multi-factorial. Our current study showed a slightly higher incidence of ptosis after combined phacotrabeculectomy with mitomycin C compared to phacoemulsification surgery although this did not reach any statistical significance. The authors feel that this could be due to the relatively small sample size and the low incidence of postoperative ptosis for both types of surgeries. However, our results showed a significantly weaker upper eyelid levator function in eyes with combined surgery compared to just phacoemulsification alone. This suggested that there could be a considerable levator dehiscence due to surgical trauma, prolonged surgery, or from use of intraoperative mitomycin C. A larger prospective study will be required to examine the differences in the incidence of postoperative ptosis between phacoemulsification and combined phacotrabeculectomy with mitomycin C. This may have clinical implications as the patients should be adequately counseled for the risk of postoperative ptosis when informed consent is sought before the AS surgeries.

Our study also showed that the trabeculectomy bleb morphology including bleb height and total bleb area could play a considerable role in upper eyelid blepharoptosis after adjusting for known risk factors such as type of anesthesia and conjunctival flap. We postulate that the increased bleb height over a more localized area (small bleb area) could have altered the physiological interaction between the upper lid and the globe and that could have resulted in levator weakness. Alternatively, the trabeculectomy bleb or the limbal sutures used for wound closure could have resulted in prolonged conjunctival inflammation under the upper eyelid, thereby causing the ptosis. The underlying mechanism of persistent ptosis is controversial but seems to indicate that there is significant aponeurotic dehiscence which has been previously attributed to various factors such as prolonged eyelid edema, superior rectus bridle sutures, and prolonged compression with the speculum. In our study, no superior bridle suture was used for all the patients. However, prolonged speculum compression during the surgery could have resulted in compromised vascular flow to the levator muscle or cause

traumatic aponeurotic dehiscence.^[10] In addition, the prolonged duration of surgery from combined phacotrabeculectomy may also contribute to the development of postoperative ptosis.^[11]

There were several limitations of our study which included a lack of preoperative eyelid measurements, small sample size, lack of photographic documentation, possible confounders in the phacotrabeculectomy group such as longer period of topical anti-glaucoma drug usage. As this is a retrospective study, certain information was not readily available including factors which could have contributed to ptosis such as the chronic use of contact lenses. Further prospective studies with standardized protocols with a larger sample size are required to overcome these limitations.

Conclusion

Our study showed that the incidence of persistent ptosis after phacoemulsification or combined with trabeculectomy and mitomycin C is low and similar for both surgeries in a multiethnic Asian population although it is slightly higher in the latter group without statistical significance. Bleb morphology may play an important role in postoperative ptosis development and should be considered in the evaluation of upper eyelid blepharoptosis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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