

# Risk factors for choroidal detachment after trabeculectomy with mitomycin C

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**Purpose:** To evaluate the risk factors for choroidal detachment after trabeculectomy with mitomycin C (MMC).

**Materials and methods:** We retrospectively evaluated 420 patients (420 eyes) with glaucoma who underwent trabeculectomy with MMC between June 1, 2005 and December 31, 2010 at Kumamoto University Hospital, Japan. Choroidal detachment after trabeculectomy was defined as a solid-appearing elevation of the retina and choroid. Logistic multivariable analysis was applied to determine the risk factors for choroidal detachment. The following factors were assessed: gender, age, subtypes of glaucoma, eye laterality, history of previous cataract surgery, preoperative intraocular pressure (IOP; mean of three Goldmann applanation readings recorded on different days), postoperative IOP (mean of seven Goldmann applanation readings recorded on 7 consecutive days after trabeculectomy), and postoperative laser suture lysis.

**Results:** Of the 420 patients, 79 (18.8%) revealed choroidal detachments. The mean period between trabeculectomy and choroidal detachment was  $6.1 \pm 3.6$  days. The mean IOP at the time of the choroidal detachment was  $5.5 \pm 3.6$  mmHg. Age (odds ratio [OR] = 1.028/year,  $P = 0.0068$ ) and postoperative IOP (OR = 0.887/mmHg,  $P < 0.0001$ ) were risk factors for choroidal detachment after trabeculectomy. The subgroup analysis for eyes with open angle glaucoma (201 patients) revealed that age (OR = 1.060/year,  $P = 0.0040$ ) and postoperative IOP (OR = 0.898/mmHg,  $P = 0.0110$ ) were significant risk factors for choroidal detachment after trabeculectomy with MMC.

**Conclusion:** Among glaucoma patients, older age and lower postoperative IOP are risk factors for choroidal detachment after trabeculectomy with MMC. In eyes with open angle glaucoma, older age and lower postoperative IOP are risk factors for choroidal detachment after trabeculectomy with MMC.

**Keywords:** choroidal detachment, intraocular pressure, mitomycin C, trabeculectomy

## Introduction

Choroidal detachment is a common complication of trabeculectomy.<sup>1</sup> Most detachments are transient in nature and occur during the early postoperative period. The incidence of choroidal detachment after trabeculectomy is reported to be 5%–44%.<sup>1–5</sup> Hypotony after trabeculectomy causes fluid to accumulate in the suprachoroidal space, which can consequently lead to choroidal detachment. Some reports suggest that choroidal detachment causes inflammation in the anterior chamber, which is associated with bleb failure after trabeculectomy.<sup>3,6</sup> To treat patients suffering from persistent choroidal detachments, suprachoroidal fluid can be drained through a sclerotomy.<sup>7</sup>

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In addition to postoperative hypotony, several patient characteristics are associated with choroidal detachment.<sup>7,8</sup> However, no large-scale analyses have investigated the risk factors for choroidal detachment after trabeculectomy. The present study was designed to explore this issue in patients who had recently undergone trabeculectomy with mitomycin C (MMC).

## Material and methods

### Patient population

We retrospectively reviewed the medical records of 420 consecutive patients with glaucoma who underwent trabeculectomy with MMC at Kumamoto University Hospital, Kumamoto City, Japan, between June 1, 2005 and December 31, 2010. In patients who underwent trabeculectomy with MMC for both eyes, only the eye that was treated first was included in the analysis. There were no exclusion criteria in the retrospective study for systemic disorders or systemic medical treatment. The study was approved by the Institutional Review Board of Kumamoto University Hospital, and all study protocols adhered to the Declaration of Helsinki. In accordance with the Japanese Ministry of Health, Labor and Welfare Guidelines for Clinical Research, patients were informed of the study design through the hospital website.

### Surgical procedure

All trabeculectomies were performed following the same surgical procedure as described previously.<sup>9</sup> In brief, a conjunctival flap was created by a fornix-based incision; the creation of the scleral flap was a half-layer single flap. The concentration and the incubation of MMC were 0.4 mg/mL and 4 minutes, respectively. The fistula creation and peripheral iridectomy were performed routinely; 10-0 monofilament nylon sutures were used for the closure of the scleral flap and the conjunctiva. After surgery, a similar topical medical regimen – 0.1% topical betamethasone, 1% topical atropine sulfate, and 0.5% topical levofloxacin – was applied to all the patients.

### Main outcome measures

Our main purpose was to identify the risk factors for choroidal detachment as an early postoperative complication (within 7 days) after trabeculectomy with MMC. Postoperative choroidal detachment was defined as a solid-appearing elevation of the retina and choroid with fundoscopic examination.

## Statistical analysis

The JMP version 8 statistical package program (SAS Institute, Inc, Cary, NC, USA) was used for data analysis. Patient characteristics were compared between patients with and without choroidal detachments by using the Mann–Whitney *U* test or the  $\chi^2$  test for independence. The following factors were assessed: patient gender, patient age, subtypes of glaucoma, eye laterality, history of previous cataract surgery, preoperative intraocular pressure (IOP; mean of three Goldmann applanation readings recorded on different days), postoperative IOP (mean of seven Goldmann applanation readings recorded on 7 consecutive days after trabeculectomy), the lowest postoperative IOP (Goldmann applanation readings recorded 7 days after trabeculectomy), and postoperative laser suture lysis. Multivariable analysis was performed in conjunction with the logistic analysis. To perform the subgroup analysis among open angle glaucoma patients, patient gender, patient age, subtypes of glaucoma, eye laterality, history of previous cataract surgery, preoperative IOP, postoperative IOP, the lowest postoperative IOP, and postoperative laser suture lysis were compared between the two groups. *P*-values < 0.05 were considered statistically significant. Data are presented as mean  $\pm$  standard deviation.

## Results

A total of 420 patients (420 eyes) met the study criteria. All the patients were Japanese; their baseline characteristics are presented in Table 1. Of these, 79 (18.8%) presented choroidal detachment after trabeculectomy with MMC. Table 2 presents a comparison between the groups with and without choroidal detachments. The mean period between trabeculectomy and choroidal detachment was  $6.1 \pm 3.6$  days, with a mean IOP of  $5.5 \pm 3.6$  mmHg on the first day of choroidal detachment. The patients in the choroidal detachment group were significantly older than those in the non-choroidal detachment group (*P* = 0.005). Moreover, the mean and lowest postoperative IOP were significantly lower in the choroidal detachment group than the non-choroidal detachment group (*P* < 0.001). However, there were no significant differences between the groups in terms of gender ratio, subtypes of glaucoma, eye laterality, history of previous cataract surgery, or postoperative laser suture lysis. Logistic analysis of these 420 patients (Table 3) confirmed that the risk factors for choroidal detachment were older age (odds ratio [OR] = 1.028; *P* = 0.0068) and lower postoperative IOP (OR = 0.887; *P* < 0.0001).

**Table 1** Demographic characteristics of patients

Characteristic	Value (%)
Gender	
Male	291 (69.3)
Female	129 (30.7)
Age, years	
Mean $\pm$ SD	65.0 $\pm$ 14.4
Range	13–90
Eye laterality	
Right	179 (42.6)
Left	241 (57.4)
Subtype of glaucoma	
Primary open angle glaucoma	112 (26.7)
Neovascular glaucoma	108 (25.7)
Exfoliation glaucoma	89 (21.2)
Primary angle closure glaucoma	34 (8.1)
Secondary glaucoma	77 (18.3)
Uveitis	58 (13.8)
Others	19 (4.5)
Preoperative IOP (mmHg)	
Mean $\pm$ SD	31.4 $\pm$ 9.8
Range	13.7–61.0
History of cataract surgery	
Yes	198 (47.1)
No	222 (52.9)
Mean IOP between 1 and 7 days after the surgery (mmHg)	
Mean $\pm$ SD	13.0 $\pm$ 6.8
Range	0–38.4
Postoperative laser suture lysis	
Yes	135 (32.1)
No	285 (67.9)

**Abbreviations:** IOP, intraocular pressure; SD, standard deviation.

Table 4 presents a comparison between the choroidal detachment and non-choroidal detachment groups in patients with open angle glaucoma (201 eyes). In total, 39 (19.4%) patients experienced choroidal detachments. Moreover, the choroidal detachment group comprised significantly older patients ( $P = 0.005$ ) along with reduced mean and lowest postoperative IOP values ( $P < 0.001$ ). Significantly more patients in the nonchoroidal detachment group were treated with laser suture lysis ( $P = 0.023$ ). Furthermore, logistic analysis of these 201 patients (Table 5) demonstrated that the risk factors for choroidal detachment in patients with open angle glaucoma were older age (OR = 1.060;  $P = 0.0040$ ) and reduced postoperative IOP (OR = 0.898;  $P = 0.0110$ ).

## Discussion

The present study identified the following risk factors for choroidal detachment after trabeculectomy with MMC: older age (OR = 1.028 per year increase;  $P = 0.0068$ ) and reduced postoperative IOP (OR = 0.887 per mmHg increase;  $P < 0.0001$ ). Subgroup analysis among the 201 patients

**Table 2** Comparison of patient data between choroidal detachment and non-choroidal detachment groups

Characteristic	Value (%)		P-value
	CD (+) (n = 79)	CD (-) (n = 341)	
Gender			0.540
Male	57 (72.2)	234 (68.6)	
Female	22 (27.8)	107 (31.4)	
Age, years			0.005*
Mean $\pm$ SD	69.0 $\pm$ 14.6	64.0 $\pm$ 14.2	
Range	29–87	13–90	
Subtypes of glaucoma			
Primary open angle glaucoma	20 (25.3)	92 (27.0)	
Exfoliation glaucoma	19 (24.1)	70 (20.5)	
Primary angle closure glaucoma	10 (12.7)	24 (7.0)	
Neovascular glaucoma	12 (15.2)	96 (28.2)	
Secondary glaucoma	18 (22.8)	59 (17.3)	
Uveitis	14 (17.7)	44 (13.0)	
Others	4 (5.1)	15 (4.4)	
Eye laterality			0.354
Right	30 (38.0)	149 (43.7)	
Left	49 (62.0)	192 (56.3)	
History of previous cataract surgery			0.417
Yes	34 (43.0)	164 (48.1)	
No	45 (57.0)	177 (51.9)	
Preoperative IOP, mmHg			0.691
Mean $\pm$ SD	30.7 $\pm$ 9.3	31.4 $\pm$ 9.9	
Range	17.7–48.0	6.5–61	
Postoperative IOP, mmHg			<0.001*
Mean $\pm$ SD	9.7 $\pm$ 6.0	13.8 $\pm$ 6.7	
Range	0–32.0	1.1–38.4	
Period between the surgery and CD, days			
Mean $\pm$ SD	6.1 $\pm$ 3.6		
Range	1–18		
IOP on the first day of CD, mmHg			
Mean $\pm$ SD	5.5 $\pm$ 3.6		
Range	0–24		
The lowest postoperative IOP, mmHg			<0.001*
Mean $\pm$ SD	3.9 $\pm$ 3.5	7.9 $\pm$ 4.5	
Range	0–18	0–31	
Postoperative laser suture lysis			0.087
Yes	19 (24.1)	116 (34.0)	
No	60 (75.9)	225 (66.0)	

**Note:** \* $P < 0.05$ .

**Abbreviations:** CD, choroidal detachment; IOP, intraocular pressure; SD, standard deviation.

with open angle glaucoma demonstrated that older age (OR = 1.060 per year increase;  $P = 0.0040$ ) and reduced postoperative IOP (OR = 0.898 per mmHg increase;  $P < 0.0110$ ) were risk factors for choroidal detachment as well.

Because choroidal detachment is a transient complication of trabeculectomy, the risk factors for choroidal detachment

**Table 3** Logistic regression analysis of choroidal detachment after trabeculectomy

Variable	OR	95% CI	P-value
Gender (man/woman)	1.154	0.658–2.078	0.6225
Age (year)	1.028	1.008–1.050	0.0068*
Laterality (right/left)	0.764	0.446–1.290	0.3190
History of cataract surgery	0.767	0.447–1.302	0.3288
Preoperative IOP (mmHg)	1.010	0.982–1.038	0.4679
Postoperative IOP (mmHg)	0.887	0.838–0.934	<0.0001*
Postoperative laser suture lysis	1.007	0.531–1.872	0.9816

Note: \*P < 0.05.

Abbreviations: CI, confidence interval; IOP, intraocular pressure; OR, odds ratio.

**Table 4** Comparison of patient data between patients with open eye glaucoma in the choroidal detachment and nonchoroidal detachment groups in open angle glaucoma (201 eyes)

Characteristic	Value (%)		P-value
	CD (+) (n = 39)	CD (-) (n = 162)	
Gender			0.626
Male	28 (71.8)	112 (69.1)	
Female	11 (28.2)	50 (30.9)	
Age, years			0.005*
Mean ± SD	75.1 ± 10.3	69.5 ± 14.3	
Range	40–87	13–90	
Subtypes of glaucoma			0.385
Primary open angle glaucoma	20 (51.3)	86 (55.8)	
Exfoliation glaucoma	19 (48.7)	68 (44.2)	
Eye laterality			0.403
Right	13 (33.3)	63 (40.9)	
Left	26 (66.7)	91 (59.1)	
History of previous cataract surgery			0.641
Yes	15 (38.5)	65 (42.2)	
No	24 (61.5)	89 (57.8)	
Preoperative IOP, mmHg			0.691
Mean ± SD	27.9 ± 8.4	27.0 ± 7.7	
Range	14.7–48.0	13.7–51.0	
Postoperative IOP, mmHg			<0.001*
Mean ± SD	9.3 ± 6.6	12.6 ± 5.6	
Range	0–32.0	3.4–33.9	
Period between the surgery and CD, days			
Mean ± SD	6.2 ± 3.6		
Range	1–13		
IOP on the first day of CD, mmHg			
Mean ± SD	6.3 ± 4.4		
Range	0–24		
The lowest postoperative IOP, mmHg			<0.001*
Mean ± SD	3.6 ± 3.6	7.3 ± 3.9	
Range	0–18	0–20	
Postoperative laser suture lysis			0.023*
Yes	7 (17.9)	60 (37.0)	
No	32 (82.1)	102 (63.0)	

Note: \*P < 0.05.

Abbreviations: CD, choroidal detachment; IOP, intraocular pressure; SD, standard deviation.

**Table 5** Logistic regression analysis of choroidal detachment after trabeculectomy in open angle glaucoma

Variable	OR	95% CI	P-value
Gender (man/woman)	1.202	0.526–2.893	0.6698
Age (year)	1.060	1.021–1.108	0.0040*
Laterality (right/left)	0.670	0.296–1.455	0.3211
Subtype (POAG/EXG)	1.187	0.544–2.621	0.6661
History of cataract surgery	0.496	0.215–1.102	0.0905
Preoperative IOP (mmHg)	1.015	0.966–1.065	0.5314
Postoperative IOP (mmHg)	0.898	0.822–0.970	0.0110*
Postoperative laser suture lysis	0.625	0.220–1.633	0.3524

Note: \*P < 0.05.

Abbreviations: CI, confidence interval; EXG, exfoliation glaucoma; IOP, intraocular pressure; OR, odds ratio; POAG, primary open angle glaucoma.

have not been previously analyzed in a large-scale case series. It has been well known that choroidal detachment occurs in hypotonic eyes after intraocular surgeries including trabeculectomy.<sup>10,11</sup> In our present study, IOPs after trabeculectomy were significantly lower in the choroidal detachment group than the nonchoroidal detachment group. However, seven patients revealed the lowest IOPs of 10 mmHg or higher. This finding suggests that factors other than hypotony might contribute to choroidal detachment. A previous report suggested that older glaucoma patients often encounter choroidal detachment after trabeculectomy.<sup>8</sup> Jampel et al<sup>8</sup> reported that, among the postoperative complications in 300 glaucomatous patients who had recently undergone trabeculectomy, choroidal detachment, synechiae in the anterior chamber, and wound leak were significantly associated with older age. However, the surgical procedure used for the trabeculectomy was not standardized across these studies. Antimetabolites such as MMC and 5-fluorouracil were used in some patients but not in others. Consistent with the previous report, our present study confirmed that older patients are at higher risk for choroidal detachment following trabeculectomy with MMC.

The underlying reason for this trend remains to be determined. However, one of the mechanisms suggested regarding choroidal detachment is that the dissociation in the ciliary body of the hypotonic eye allows the aqueous humor to flow into the suprachoroidal space.<sup>12</sup> Another explanatory mechanism is that hypotony enhances the vascular permeability of the choriocapillaris.<sup>13,14</sup> Similarly, the eyes of older individuals might contain relatively fragile connective tissue, which would enhance fluid movement through the uveal tissue and the vascular wall.

Notably, this study had certain limitations because of its retrospective nature. First, we could not quantify the volume or extension of each patient's choroidal detachment.

We did not distinguish between subtle and massive choroidal detachments. Second, we did not quantify the degree of postoperative inflammation, which increases the vascular permeability of the choriocapillaris.<sup>13</sup> Further prospective observational studies could help in confirming the validity of our retrospective data.

## Conclusion

In conclusion, the present study revealed that postoperative hypotony and older age led to an increased likelihood of developing a choroidal detachment after trabeculectomy with MMC. These findings could help us in determining the postoperative management of glaucoma patients who have undergone trabeculectomy with MMC.

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## Disclosure

The authors report no conflicts of interest in this work.

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