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Case Report

# Delayed-Onset, Recurrent Hyphema after Microhook ab interno Trabeculotomy

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## Keywords

Microhook ab interno trabeculotomy · Minimally invasive glaucoma surgery · Surgical complication · Delayed-onset hyphema

## Abstract

Trabeculotomy (LOT) and related goniotomy surgeries can be divided into two classes based on the excision or incision of the trabecular meshwork. Previously, blood reflux from Schlemm's canal (SC) after long-standing glaucoma surgery was reported in eyes treated with excisional LOT. The current case is one of delayed-onset hyphema after incisional LOT. An 87-year-old woman with bilateral normal-tension glaucoma had undergone microhook ab interno LOT ( $\mu$ LOT) combined with small incisional cataract surgery in both eyes 4 years previously. At the scheduled 4-year follow-up visit, numerous red blood cells floating in the anterior chamber, angle hyphema, and opening of the LOT cleft were observed in the right eye. No possible cause of hyphema such as rubeosis, Swan syndrome, or uveitis-glaucoma-hyphema syndrome was identified. This case suggests that SC can remain open for an extended time even after incisional LOT such as  $\mu$ LOT.

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## Introduction

Trabeculotomy (LOT) and related goniotomy surgeries can be classified based on the excision or incision of the trabecular meshwork (TM); use of the Trabectome (MicroSurgical

Technology Inc., Redmond, WA, USA) [1] and Kahook Dual Blade (New World Medical Inc., Rancho Cucamonga, CA, USA) [2] are considered excisional procedures, and gonioscopy-assisted transluminal LOT (also referred to as 360° suture LOT) [3, 4], canaloplasty [5], and microhook ab interno LOT ( $\mu$ LOT) [6, 7] are considered incisional procedures. Previously, sealing of LOT cleft was reported to be caused by granulation, fusion of the remaining leaflets, goniosynechiae (focal iris synechiae in the scleral spur or posterior TM), or peripheral anterior synechiae (iris adhesions obscuring the meshwork) [1, 8]. The excisional procedure was developed to minimize them in areas in which surgery was performed [1], although many surgeons also have reported sustained intraocular pressure (IOP) reductions after incisional LOT [9–12].

Previously, postsurgical blood reflux from Schlemm's canal (SC) after an extended follow-up period has been reported in eyes treated with excisional LOT, i.e., Trabectome [13, 14]. The current case is one in whom delayed-onset hyphema developed in an eye treated with incisional LOT, i.e.,  $\mu$ LOT.

## Case Report

An 87-year-old woman with bilateral normal-tension glaucoma had undergone  $\mu$ LOT combined with small incisional cataract surgery in both eyes (OU) 4 years previously. LOT was performed using microhooks (M-2215; Inami & Co., Ltd., Tokyo, Japan) under observation using a Swan-Jacob gonioscope lens (Ocular Instruments, Bellevue, WA, USA) [15]. The inner wall of SC and the TM were incised circumferentially for 3 clock hours in the nasal angle of the right eye (OD) and the temporal angle of the left eye (OS). Cataract surgery was performed through a 2.2-mm-wide corneal incision OU, and a single-piece soft acrylic intraocular lens (XY-1; Hoya, Tokyo, Japan) was implanted into the capsular bag OU. No intraoperative or early postoperative complications other than mild hyphema were recorded OU. Preoperatively, the best-corrected visual acuity (BCVA) was 0.01 OD and 0.4 OS; the IOP was 15 mm Hg OU with once-daily topical instillation of 0.005% latanoprost drops. Postoperatively, BCVA was counting fingers to 0.01 OD and 0.5–0.8 OS; IOP was 9–13 mm Hg OD and 8–12 mmHg OS with latanoprost OU. At the scheduled 4-year follow-up visit, BCVA was counting fingers OD and 0.6 OS, and IOP was 11 mm Hg OU. Slit-lamp examination (Fig. 1a) showed numerous red blood cells (RBCs) floating in the anterior chamber OD; however, no evidence of uveitis, inflammation, or iris rubeosis was seen. Gonioscopy showed angle hyphema in the inferior angle (Fig. 1b), and the LOT cleft was open in the nasal angle (Fig. 1c), while no abnormal blood vessel formation or pigmentation was observed in any quadrant of the angles (Fig. 1b–e) OD. Dilated fundus examination showed no vitreous or retinal hemorrhages or any marked changes OU. The patient was diagnosed with delayed-onset hyphema due to blood reflux from the previously incised angle; no further treatment was added, and the patient was observed. Two months later, BCVA and IOP were unchanged OU; very few floating RBCs were present in the anterior chamber, but no angle hyphema was seen by gonioscopy OD. Four months later, BCVA was unchanged and IOP was 15 mm Hg OD and 11 mm Hg OS; numerous floating RBCs were seen in the anterior chamber and angle hyphema was seen in the inferior angle. The patient had no history of ocular trauma or use of anticoagulant or antiplatelet drugs.

## Discussion and Conclusion

Blood reflux from SC during trabeculectomy was reported in an eye that had undergone Trabectome 11 months previously [13]. Subsequently, 12 cases with delayed-onset hyphema (later than 2 months) have been reported after Trabectome procedures [14]. More recently, delayed-onset hyphema was reported in one case 6 months after gonioscopy-assisted trans-luminal LOT [3], and in one case 13 months after iStent trabecular microbypass shunt (Glaukos Corp., San Clemente, CA, USA) [16]. To the best of my knowledge, delayed-onset, recurrent hyphema after incisional LOT is unique in the literature.

In the current case, no possible cause of hyphema was apparent, such as rubeosis, ingrowth of episcleral vessels at the site of the previous corneal incision associated with Swan syndrome [17, 18], heavy angle pigmentation, or unstable intraocular lens fixation associated with uveitis-glaucoma-hyphema syndrome [19, 20]. Previously, an acute IOP decrease during ocular surgery [13] or an exertion-related increase in episcleral venous pressure or ocular compression from sleeping on the surgical side followed by sudden decompression [14] have been suspected as mechanisms of hyphema. Although the current patient was unaware of the onset because of poor vision OD, ocular decompression during normal daily activities may have been associated with the hyphema in this case. It is possible that occurrence of hyphema accompanies a transient IOP rise; however, since the delayed-onset hyphema after incisional and excisional LOT seemed mild and self-limiting in my and previous [3, 13, 14] cases, I presume that simple observation or addition of medication rather than aggressive interventions is the choice of treatment.

Permanent removal of the TM and the inner wall of SC has been considered to play key roles in such blood reflux [13, 14]; however, the current case suggests that SC can open for an extended time even after incisional LOT such as  $\mu$ LOT.

## Statement of Ethics

This study adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from the patient for publication of this case report and any accompanying pictures, and recorded in the patient's medical chart.

## Conflict of Interest Statement

The microhooks used were co-developed by Masaki Tanito, MD, PhD and Inami & Co., Ltd., and provided by Inami & Co., Ltd. Dr. Tanito receives royalties from Inami & Co., Ltd.

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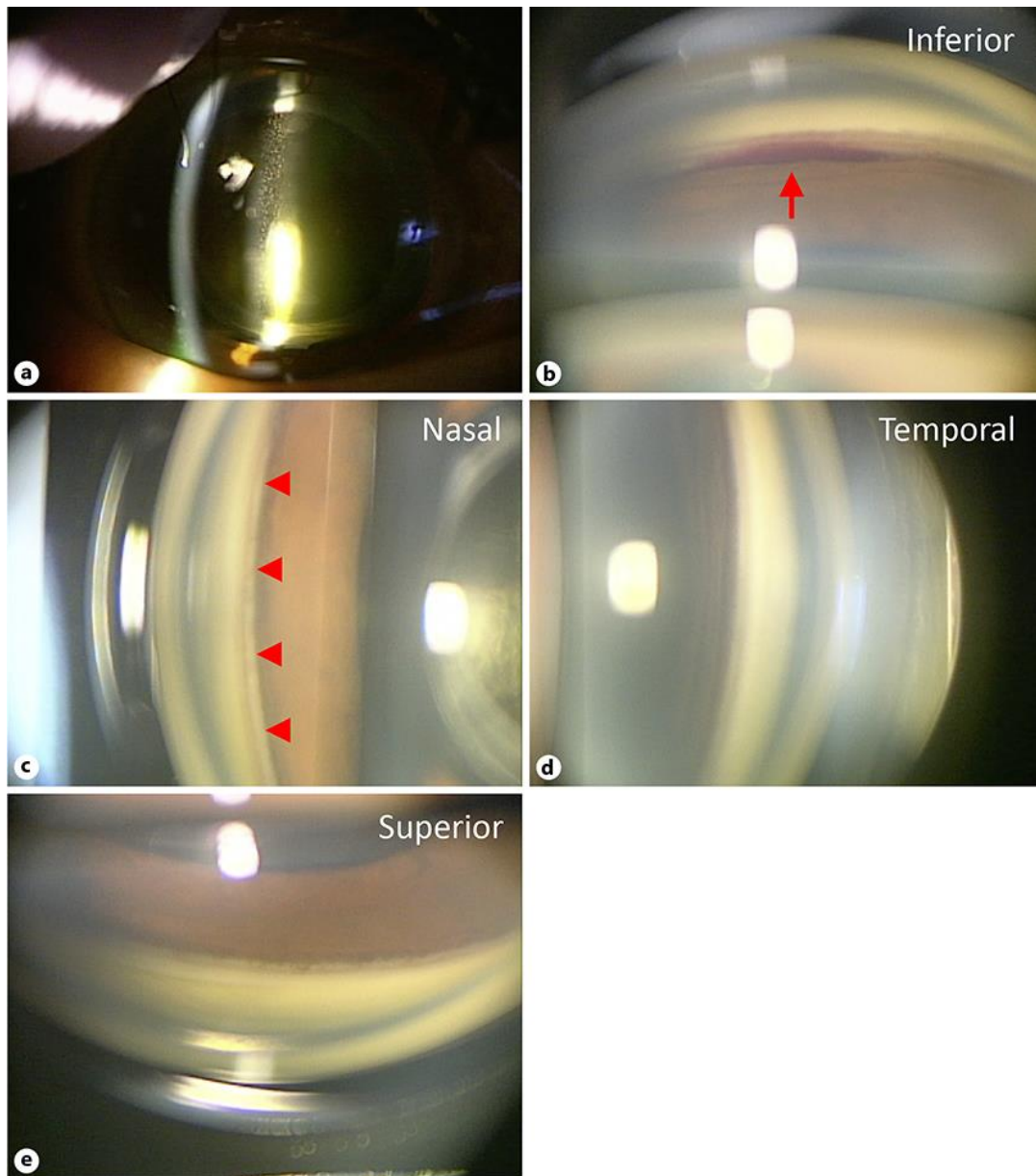
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## Author Contributions

The author agrees to be responsible for all aspects of this work.

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**Fig. 1.** Slit-lamp and gonioscopic findings at the 4-year follow-up visit after microhook ab interno LOT. **a** Slit-lamp examination shows RBCs floating in the anterior chamber. **b** The RBCs are accumulated in the inferior angle (arrow). **c** The LOT cleft is seen in the nasal angle (arrowheads). **a–e** No evidence of rubeosis, ingrowth of episcleral vessels, or heavy pigmentation is seen in the entire angle. LOT, trabeculotomy; RBCs, red blood cells.