—Case Reports—

# 24-Hour Intraocular Pressure Fluctuation Suppressed by Microhook Trabeculotomy in Ocular Hypertension: A Case Report

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A 76-year-old woman was referred to our hospital for evaluation of markedly high intraocular pressures (IOPs): ≥40 mmHg in both eyes. No intraocular inflammation, pseudoexfoliation, or glaucomatous optic neuropathy was observed on ophthalmological examination. The 24-hour IOP fluctuations, measured with a Goldmann tonometer in the sitting position at 8, 12, 16, 20, and 24 o'clock, were 22/17, 33/28, 41/33, 30/22, and 30/24 mmHg, respectively, and showed a peak in the afternoon. The patient was diagnosed with ocular hypertension, and microhook trabeculotomy (μLOT) (right eye with lens reconstruction, left eye initially pseudophakic) was performed. After μLOT surgery in both eyes (4 days postoperatively in the right eye and 1 day postoperatively in the left eye), IOP decreased in both eyes to 12/15, 11/14, 12/15, 10/11, and 10/10 mmHg, and the fluctuation range was suppressed. At 3 months postoperatively (measured at 8, 12, 16, 20, 24, and 4 o'clock), the effect was maintained at 14/15, 15/19, 14/19, 11/12, 13/14, and 13/13 mmHg, respectively, but was slightly attenuated. In a patient with marked 24-hour IOP fluctuation, μLOT was effective in reducing IOP values and fluctuation.
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**Key words:** 24-hour intraocular pressure, microhook trabeculotomy diurnal intraocular pressure variation, nocturnal intraocular pressure, glaucoma

## Introduction

Glaucoma is a leading cause of progressive visual field loss[1]. Currently, the most reliable treatment is lowering of intraocular pressure (IOP)[2]. IOP-lowering treatment for glaucoma includes medication, laser treatment, and surgical treatment[3]. Surgical intervention is often indicated when modalities such as drug and laser treatment do not sufficiently lower IOP[1,4]. The most widely performed procedure for most types of glaucoma, including primary open-angle glaucoma (POAG), is trabeculectomy (TLE)[3,4]. Although TLE is highly effective in lowering intraocular pressure, postoperative hypotony and late complications are relatively common, and frequent postoperative hospital visits are required, placing a heavy burden on the patient[5]. Recently, a microinvasive surgical procedure for glaucoma, microinvasive glaucoma surgery (MIGS), has come into clinical use[6]. Microhook trabeculotomy (μLOT) is a MIGS technique that uses a microhook to incise the fibrovascular zone and release outflow resistance of the inner wall of Schlemm's canal[7,8]. Generally, μLOT is simpler than TLE in terms of surgical technique and postoperative management but is less effective in lowering IOP[9,10]. This report describes a case in which μLOT significantly lowered IOP and suppressed 24-hour IOP fluctuation.

## Case Report

A 76-year-old woman was referred to our hospital for evaluation of high intraocular pressures (IOPs) of ≥40 mmHg in both eyes, measured on multiple occasions, despite receiving 5-drug combination therapy. At her initial visit, her spherical equivalents were −2.5D (right) and

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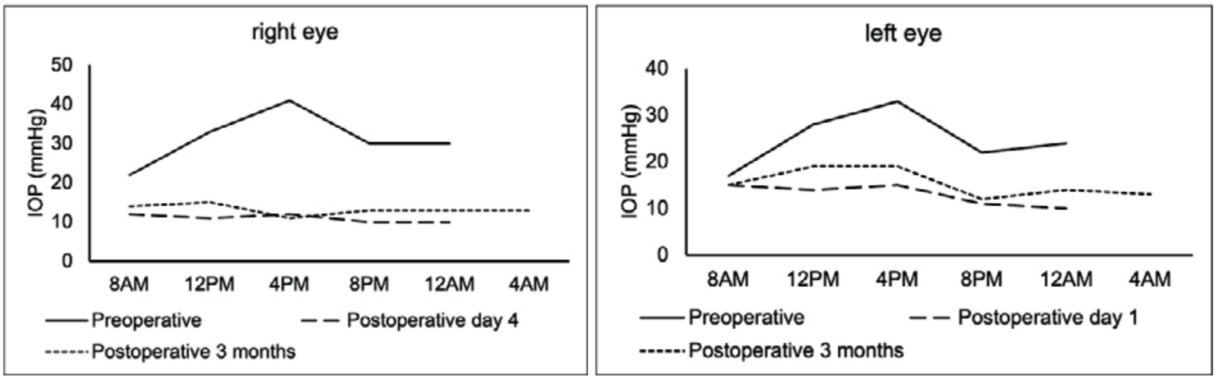


Fig. 1 24-hour sitting intraocular pressure before and after surgery
Preoperatively, there was marked afternoon peak-type 24-hour IOP fluctuation. Postoperatively, IOP was lower at all measurement times, and 24-hour IOP fluctuation was suppressed. The IOP-lowering effect was maintained at 3 months postoperatively, but slightly weakened in the left eye, which exhibited the same daily IOP fluctuation pattern seen preoperatively.

−2.25D (left), and her corrected visual acuity was 20/20 in both eyes. IOP on Goldmann applanation tonometry was 22/20 mmHg. Her ocular axis lengths were 24.41 mm (right) and 24.63 mm (left). Her central corneal thicknesses were 521 µm (right) and 525 µm (left). Both eyes were treated with a regimen including tafluprost ophthalmic solution 0.0015% (tafluprost) eye drops once per day each night at bedtime, dorzolamide hydrochloride 1% (dorzolamide)/timolol maleate 0.5% (timolol) fixed eye drops twice per day, brimonidine tartrate ophthalmic solution 0.1% (brimonidine) twice per day, and ripasudil hydrochloride hydrate ophthalmic solution 0.4% (ripasudil) twice per day. Slit lamp examination showed normal findings in both eyes. The right eye had a primary cataract, and the left eye had an intraocular lens inserted. Gonioscopy showed open angles in both eyes. There was no evidence of ocular inflammation or pseudoexfoliation. Fundoscopy findings were normal, with no optic disc abnormalities in either eye. Humphrey perimetry program 30-2 performed by a previous doctor showed normal findings in both eyes. Morning ambulatory IOPs measured multiple times during 5-drug therapy were 22-26 mmHg in the right eye and 19-20 mmHg in the left eye. IOP measurement at 4 pm, coinciding with the time of her visits to her previous doctor, showed marked IOP elevation (51 mmHg in the right eye, 39 mmHg in the left eye). On the basis of these findings, ocular hypertension was diagnosed. Microhook trabeculotomy (µLOT) was performed in both eyes (combined with lens reconstruction in the right eye with a cataract). Then, 24-hour IOP fluctuations were measured by using a Goldman tonometer with the patient in a sitting position before and immediately after surgery (4 days after surgery in the right eye and 1 day after surgery in the left eye) and 3 months postoperatively. Preoperative IOPs measured during hospitalization at 8, 12, 16, 20, and 24 o'clock showed marked afternoon peaks, with values of 22/17, 33/28, 41/33, 30/22, and 30/24 mmHg, respectively. After µLOT surgery (4 days postoperatively in the right eye and 1 day postoperatively in the left eye), IOPs measured during hospitalization at 8, 12, 16, 20, and 24 o'clock were lower at all times in both eyes, with values of 12/15, 11/14, 12/15, 10/11, and 10/10 mmHg, respectively, and the range of IOP fluctuation was also suppressed. Postoperative IOP measurements at 3 months at 8, 12, 16, 20, 24, and 4 o'clock confirmed that IOP remained lower (14/15, 15/19, 14/19, 11/12, 13/14, and 13/13 mmHg, respectively), although there was slight attenuation in the left eye, which returned to the preoperative pattern of IOP fluctuation (**Fig. 1**). During the 24-hour IOP fluctuations measured before surgery, shortly after surgery, and 3 months after surgery, both eyes were treated with carteolol hydrochloride 2% (carteolol)/latanoprost 0.005% (latanoprost) fixed combination eye drops once per day at bedtime, brimonidine/dorzolamide fixed combination eye drops twice per day, and ripasudil twice per day, with adjustments made to reduce the number of drops from the initial medication regimen.

Written informed consent was obtained from the patient for publication of this case report.

## Discussion

Glaucomatous optic neuropathy results in progressive deterioration of visual function[1,2]. Currently, the only evidence-based treatment for glaucoma is IOP reduction[1,2]. IOP fluctuates during the day, and large fluctuations in IOP accelerate glaucoma progression[11,12]. In the present case, preoperative 24-hour IOP measurements confirmed that IOP was much higher at night than during clinical assessment of IOP. To assess the effectiveness of μLOT, 24-hour IOP was measured twice (on the fourth day in the right eye, on the first day in the left eye, and 3 months after surgery in both eyes). At both times after surgery, the large preoperative 24-hour IOP fluctuation was suppressed. Previous reports indicate that post-μLOT suppression of IOP fluctuation is particularly notable for its marked reduction of high variability[13,14]. Our patient had marked 24-hour IOP fluctuation, particularly in the afternoon; however, μLOT was effective in lowering IOP and suppressing 24-hour IOP fluctuation postoperatively, especially in the right eye with concurrent cataract reconstruction surgery. Cataract surgery can reduce IOP in POAG[15]; thus, cataract surgery for the right eye of our patient may have resulted in additional IOP reduction.

Despite marked 24-hour IOP fluctuation, our patient had no apparent glaucomatous optic neuropathy, possibly because the duration of elevated IOP was short. Although μLOT was selected as treatment, trabeculectomy and other filtering surgeries were alternative options. In cases such as this, when IOP is >40 mmHg, μLOT is generally less effective than trabeculectomy in reducing IOP but more effective with higher preoperative IOP[16]. Trabeculectomy more reliably reduces IOP but is associated with a higher incidence of complications, such as postoperative hypotony, and a greater burden on patients[5,10]. In patients without glaucomatous optic neuropathy and mild progression, where strict IOP control is not critical, μLOT may yield sufficient IOP reduction.

In conclusion, μLOT suppressed large preoperative 24-hour IOP fluctuation during multiple-drug therapy in both eyes. In addition, the afternoon peak in IOP markedly decreased, as did 24-hour IOP fluctuation. Thus, we conclude that μLOT was effective in controlling 24-hour IOP fluctuation in a patient with ocular hypertension.

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