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Tube obstruction caused by intraocular lens capture following PreserFlo MicroShunt implantation

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ABSTRACT

Purpose: We describe a rare case of tube obstruction caused by intraocular lens (IOL) capture following a PreserFlo MicroShunt (PMS) surgery and its subsequent management.
Observations: Tube obstruction was noted following PMS implantation at 8 days postoperatively. The intraocular pressure (IOP) increased to 42 mmHg because of tube occlusion that was caused by iris and IOL capture at the tip of the tube. The occlusion was released surgically to free the lumen, and the IOP rapidly decreased to 14 mmHg.
Conclusions and importance: IOP elevation due to tube obstruction caused by iris and IOL capture after PMS surgery was resolved by surgical intervention without tube reinsertion. Extra care is required regarding the IOL position in relation to the PMS tube when hypotony occurs in the early postoperative period.

1. Introduction

Trabeculectomy is a widely performed glaucoma filtration surgery for patients with glaucoma with medically uncontrollable intraocular pressure (IOP). However, patients undergoing trabeculectomy often develop severe postoperative complications related to visual impairment.[1] Recently, minimally invasive glaucoma surgeries targeting the trabecular meshwork performed using an *ab interno* approach are popular because this approach may be more safe and has a shorter recovery time.[2] The PreserFlo MicroShunt (PMS) (Santen Pharmaceutical Co. Ltd., Osaka, Japan) is a microinvasive filtration surgical device that was approved for use in Japan in February 2022. PMS is an aqueous drainage shunt designed to be implanted *ab externo*, creating a full-thickness fistula from the anterior chamber to the subconjunctival space and a filtering bleb. PMS surgery is believed to be a less invasive glaucoma filtration surgery than trabeculectomy because the creation of a scleral flap and iridectomy is not required. In fact, a previous study suggested that PMS surgery resulted in significantly fewer postoperative interventions and a lower incidence of hypotony compared to trabeculectomy.[3] Therefore, PMS surgery may be performed more often in the future as an alternative to trabeculectomy as primary glaucoma surgery for patients with glaucoma and medically uncontrollable IOP.

We describe a rare case of tube obstruction caused by iris capture triggered by intraocular lens (IOL) displacement after PMS implantation and its successful surgical management without implant reposition. We believe this case report will help raise awareness regarding this complication and provide a reference for its management with similar scenarios.

2. Case report

This report presents the case of a 78-year-old woman of Japanese origin with bilateral advanced chronic angle closure glaucoma (CACG) secondary to plateau iris syndrome. Previously, cataract extraction and IOL implantation had been performed in both eyes, and trabeculectomy had been performed in the left eye. Preoperatively, the best corrected visual acuity was 0.6 in the right eye and 0.8 in the left eye. On Goldmann applanation tonometry, the IOP was 24 mmHg in the right eye and 18 mmHg in the left eye with the use of three different glaucoma medications (tafluprost 0.0015 %, brimonidine 0.1 %, and dorzolamide 1 % + timolol 0.5 % fixed combination). We found that the IOP elevation of the right eye could not be controlled with glaucoma medications. The mean deviation in the right eye on Humphrey visual field 24-2 SITA standard was −10.32 dB. The anterior segment of the right eye, in particular the superior conjunctiva, was normal on slit lamp examination. A standalone PMS implantation was scheduled for the right eye.

A corneal suture was placed on the superior cornea to control the eye position. A 5-mm conjunctival incision was made along the limbus with

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posterior dissection to create a fornix-based conjunctival flap. Mitomycin C (0.4 mg/mL) was applied under the Tenon's capsule for 4 minutes, and the eye was irrigated with balanced salt solution (BSS) (100 mL). Limited cauterization was applied to the episcleral vessels at the site of PMS insertion. The sclera was marked 3 mm posterior to the limbus using the provided marking instrument. A scleral tunnel and pocket were created at this location using the double-step knife provided. Then, the MicroShunt was inserted into the anterior chamber through the scleral tunnel, with the wings of the device securely inserted into the scleral pocket. Aqueous flow was confirmed by observing drainage at the posterior tip of the MicroShunt. The distal portion of the MicroShunt was fixed on the scleral surface with a 10-0 Nylon suture. The conjunctival flap was sutured watertight with two wing sutures and mattress sutures at the limbus using 10-0 Nylon. There were no intraoperative complications. The patient received postoperative topical medications with 0.5 % moxifloxacin three times per day and 0.1 % betamethasone sodium phosphate three times per day.

At postoperative day 1, the right eye IOP was 14 mmHg and had a well-positioned implant and diffuse posterior bleb. At postoperative day 2, the IOP decreased to 6 mmHg, and the anterior chamber became shallow. The tube in the anterior chamber was in contact with the iris, but the tip of the tube was not occluded. Choroidal detachment was observed in two quadrants. Postoperative transient hypotony was noted, and follow-up without any additional treatment was recommended. At postoperative day 8, the IOP increased to 42 mmHg. Slit lamp examination revealed an obstruction at the tip of the tube that was caused by iris capture and IOL displacement. Anterior segment optical coherence tomography (AS-OCT) provided good visualization of the tube occlusion. The IOL was situated at the tip of the tube along with the iris (Fig. 1). The tube was obstructed by iris incarceration that was directly caused by IOL displacement. It was difficult to resolve the tube obstruction by eye drops or laser treatment, and surgical treatment was recommended. This was performed on post-operative day 10. Two corneal side ports were created with a 15° blade. The anterior chamber maintainer was used to inflate the anterior chamber with BSS. The IOL was returned to its normal position, and the iris was also removed from the tube lumen using a Sinskey hook (Fig. 2). At 1 day after this second surgery, the IOP decreased to 7 mmHg, and the anterior chamber was deep. There was no tube occlusion or choroidal detachment. As part of the postoperative topical medication regimen, 1 % atropine was used once per day. At one month after the second surgery, the IOP was maintained at 14 mmHg without glaucoma medication use, and the lumen of the tube also remained open (Fig. 3).

3. Discussion

There are a few reports on tube obstruction after PMS implantation. These reports suggested that tube occlusion was caused by the iris and resolved by yttrium-aluminium-garnet (YAG) laser or surgical intervention.[4,5] This is a rare case report on tube obstruction caused by iris and IOL capture after PMS surgery.

In this case, we performed PMS implantation for a patient with CACG secondary to plateau iris syndrome, although PMS is indicated for eyes with open-angle glaucoma. Since the anterior chamber was deep (4.15 mm) in the eye with IOL implantation, we found that PMS surgery could be used and might be effective in our case. This specific type of glaucoma for PMS surgery might have been a risk factor for this rare complication.

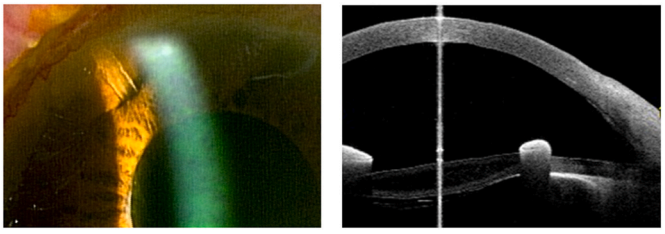

Fig. 1. Preoperative image showing that the IOL is situated at the tip of the tube along with the iris.

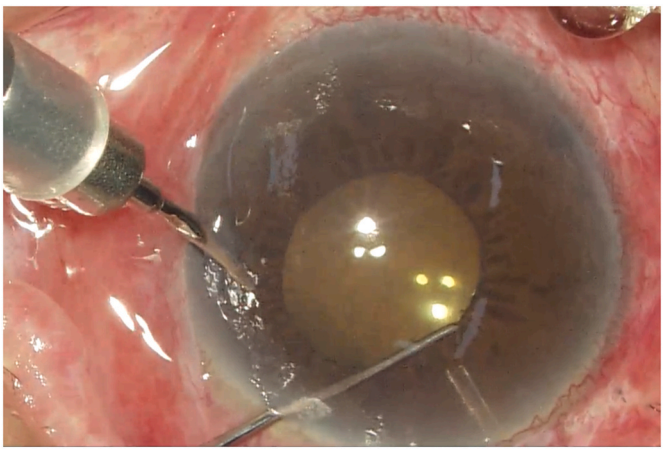

Fig. 2. Intraoperative image showing release of the tube obstruction using a Sinskey hook.

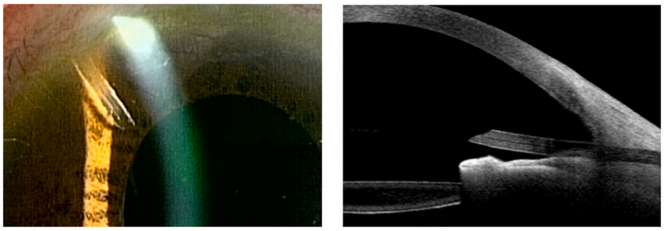

Fig. 3. Postoperative image showing an unobstructed tube.

Transient hypotony, shallowing of the anterior chamber, and tube contact with the iris are considered risk factors for tube obstruction by the iris after PMS surgery.[45] These postoperative complications occur in 11 %–69 %, 3 %–15 %, and 13 % of patients, respectively.[3,6–10] These complications were observed in our case, so it became a situation in which tube obstruction by the iris was likely to occur. However, in this case, tube occlusion was caused not only by the iris but also by the IOL capture.

The shallowing anterior chamber with transient hypotony after filtering surgery is usually caused by bleb leaks, over filtration, ciliochoroidal detachment or malignant glaucoma. In this case, no bleb leak was observed, and over filtration was not considered because of the appearance of the bleb. Therefore, it was considered that ciliochoroidal detachment or malignant glaucoma might have occurred. Several previous studies have reported the occurrence of postoperative ciliochoroidal detachment associated with transient hypotony after some types of glaucoma surgery (e.g., deep sclerectomy, trabeculectomy, and *ab interno* trabeculotomy) in the early postoperative period, owing to an acceleration of the uveoscleral outflow of aqueous humor.[11–13] Consequently, ciliochoroidal detachment will likely occur after PMS surgery as well. Ciliochoroidal detachment can be detected using AS-OCT or ultrasound biomicroscopy; however, we did not use these instruments to detect the ciliochoroidal detachment in this case. A condition similar to malignant glaucoma, such as aqueous misdirection to the posterior segment[14] or abnormal choroidal permeability in the setting of poor vitreous flow conductivity[15], might have contributed to the outcome in this case. Malignant glaucoma was frequently encountered in angle closure glaucoma after glaucoma surgery.[16,17] Therefore, we used topical atropine, which pushes the lens–iris diaphragm posteriorly, after the second surgery. Topical atropine might have been effective in

maintaining anterior chamber depth in our case. Furthermore, tube occlusion could have been avoided if topical atropine was used at the time of transient hypotony in this case.

Tube occlusion caused by iris, blood clot, vitreous or anterior capsule after glaucoma drainage device surgeries has been reported in several previous reports.[18–24] For any type of tube occlusion, surgical procedure and laser therapy using YAG or argon laser are the preferred treatment options. The surgical procedure includes release of the tube occlusion using forceps in the anterior chamber, anterior vitrectomy or pars plana vitrectomy. In this case, we selected the surgical procedure because the IOL had to be repositioned. The tube obstruction could have been resolved by pushing the IOL back with a thin needle, e.g., a 30-G needle, at the slit lamp. However, we considered that there was a risk of the anterior chamber shallowing during the abovementioned procedure, so we selected surgical intervention using an anterior chamber maintainer.

4. Conclusion

IOP elevation because of tube obstruction caused by iris and IOL capture after PMS surgery was resolved by surgical intervention without tube reinsertion. Extra care may also be required regarding the IOL position when hypotony occurs in the early postoperative period.

Statement of ethics

This study adhered to the tenets of the Declaration of Helsinki. The institutional review board of Fukui University Hospital did not require an ethics committee review process to report this case.

Patient consent

The patient provided written informed consent for publication of this case report and any accompanying pictures.

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Authorship

All authors attest that they meet the current ICMJE criteria for authorship.

Author contributions

KI performed the treatment and collected the clinical data of the subject. KI and MI wrote the manuscript, and KI, SA, and MI revised the manuscript. All authors approved the final version of the manuscript. The authors agree to be responsible for all aspects of this work.

Data availability statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

Declaration of generative AI in scientific writing

None.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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None.

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