CASE REPORT

Reviving XEN63 Gel Stent Patency in Uveitic Glaucoma: A Novel Approach Using 10-0 Nylon Probe

Vincenzo Marchese[1], Viviana Randazzo[2], Rosanna Badalamenti[3], Marco Anastasi[4]

Received on: 03 November 2023; *Accepted on:* 11 June 2024; *Published on:* 10 July 2024

Abstract

Purpose: This case report describes the possibility of XEN63 lumen obstruction at the middle of the device and emphasizes the potential to restore its flow using an ab-externo revision technique involving a 10-0 nylon suture probe, before considering more aggressive surgical interventions.

Methods: A 55-year-old female with uveitic glaucoma underwent XEN63 implantation but experienced elevated intraocular pressure (IOP) (35 mm Hg) 1 month after the operation, despite medical therapy. A flat bleb, lack of response to medication, yttrium aluminum garnet (YAG) laser treatment, and slit-lamp needling necessitated revision.

Results: An ab-externo surgical procedure was performed using a 10-0 nylon probe to release the obstruction, followed by the application of mitomycin C and removal of fibrous tissue and subconjunctival Tenon's capsule. Intraoperatively, flow was observed only after probing with the 10-0 nylon. Postoperatively, the patient's IOP decreased immediately and remained well-controlled at 2 months (8 mm Hg) without requiring further medication.

Conclusion: For patients experiencing increased inflammatory response, the XEN63 gel stent may develop deep lumen occlusion that is unresponsive to conventional treatments. This case report introduces a novel surgical technique applicable to various glaucoma devices, utilizing an ab-externo approach with a 10-0 nylon probe. The demonstrated success in reducing IOP suggests its potential as a less invasive alternative to consider before resorting to more aggressive surgical interventions.

Keywords: Case report, Minimally invasive glaucoma surgery, Uveitic glaucoma, XEN63 implant.

Journal of Current Glaucoma Practice (2024): 10.5005/jp-journals-10078-1445

Introduction

Inflammation plays a pivotal role in triggering abnormal scarring, thereby increasing the risk of glaucoma surgery failure, particularly in patients with uveitis. Managing glaucoma in individuals with uveitis presents a heightened level of complexity.[1]

In this case report, our objective is to highlight the successful application of an ab-externo revision technique, assisted by a 10-0 nylon probe, to effectively restore the patency of the XEN63 gel stent. This intervention was deemed necessary due to late occlusion observed postoperatively in a uveitic glaucoma patient who showed minimal response to medication and less invasive treatments.

Case Description

A 65-year-old female with secondary glaucoma due to idiopathic uveitis presented with uncontrolled intraocular pressure (IOP) of 35 mm Hg. Despite receiving maximum tolerated topical medications (timolol, dorzolamide, bimatoprost, and iopidine) and oral therapy (acetazolamide 250 mg three times daily), her condition remained uncontrolled for 1 month. Therefore, she was referred to us for possible surgery (Fig. 1).

After lengthy discussion with the patient, explaining the pros and cons of medical therapy vs surgery, a new XEN63 (Allergan Inc., an AbbVie company) device implantation surgery was performed. Postoperative treatment includes antibiotics and hourly dexamethasone 0.1%, tapered over the course of several weeks.

During the subsequent follow-up appointments at 1, 3, 7, 14, and 21 days postsurgery, IOP consistently remained below 10 mm Hg. The lowest recorded IOP was 5 mm Hg, noted on the 1st day after the operation. However, despite the rigorous use of topical steroids (dexamethasone 0.1% every 2 hours), approximately 1 month following the combined cataract surgery and XEN implantation, the patient experienced a substantial increase in pressure, with an IOP reaching 35 mm Hg. This elevated pressure was attributed to a possible blockage of the device and was accompanied by the presence of a flat, nondraining bleb with elevated IOP (see Figs 2A and B).

[1,3]Department of Ophthalmology, S Antonio Abate Hospital, Trapani, Sicily, Italy

[2]Department of Ophthalmology, Ospedali Riuniti Villa Sofia-Cervello, Palermo, Sicily, Italy

[4]Royal Free London NHS Foundation Trust, London, United Kingdom; Department of Neurosciences, Biomedicine and Movement Sciences, University of Verona, Verona, Italy

Corresponding Author: Viviana Randazzo, Department of Ophthalmology, Ospedali Riuniti Villa Sofia-Cervello, Palermo, Sicily, Italy, Phone: +393490996496, e-mail: vivianarandazzo86@gmail.com

How to cite this article: Marchese V, Randazzo V, Badalamenti R, *et al.* Reviving XEN63 Gel Stent Patency in Uveitic Glaucoma: A Novel Approach Using 10-0 Nylon Probe. J Curr Glaucoma Pract 2024;18(2):74–78.

Source of support: Nil

Conflict of interest: None

Patient consent statement: The author(s) have obtained written informed consent from the patient for publication of the case report details and related images.

Considering the likelihood of inflammatory debris obstructing the implant in uveitic eyes,[2–4] and the ineffectiveness of the reintroduction of medical treatment in reducing the IOP, a stepwise approach was adopted.

Initially, yttrium aluminum garnet (YAG) laser treatment was attempted. Three shockwaves of 0.6 mJ power each were delivered near the internal lumen of the XEN 65 implant, aiming to disperse any concealed intraluminal cellular debris and enhance flow through the compromised XEN microstent.

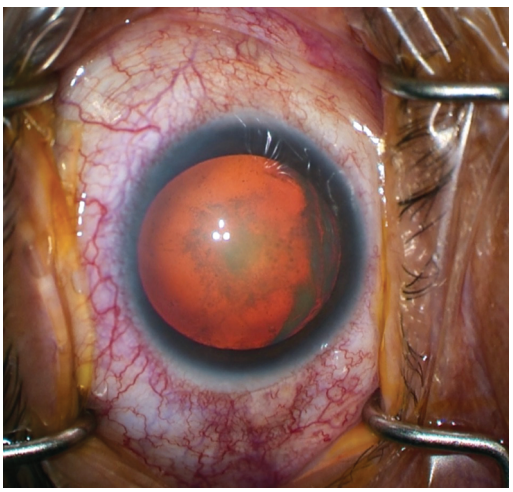


Fig. 1: Intraoperative photograph of uveitic cataract with uncontrolled IOP

Regrettably, this treatment yielded no improvement in our patient's condition.

Subsequently, 1 week later, a needling procedure was performed at the slit lamp. The intention was to open the fibrotic conjunctiva, but it did not sufficiently lower the IOP.

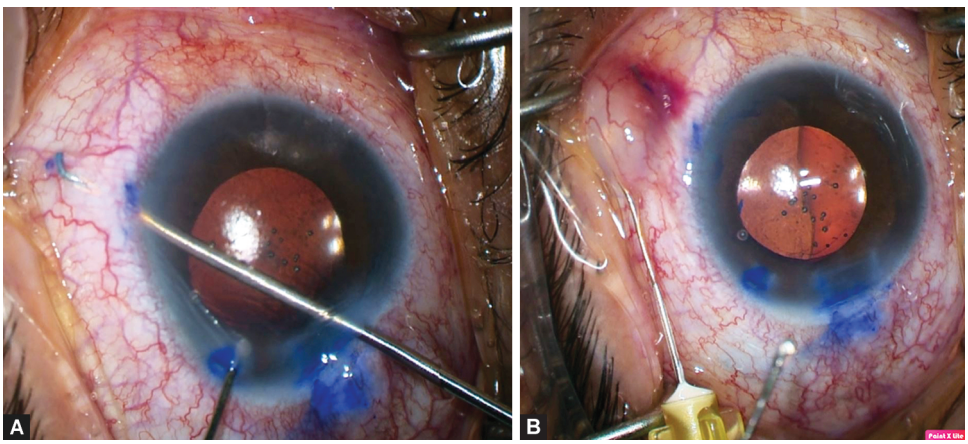
Therefore, a surgical intervention under microscopic guidance was undertaken 1 week after the slit lamp needling to expose the XEN63 covered by the Tenon capsule and fibrotic tissue, aiming to restore aqueous flow (see Figs 3A and B).

Technique and Post-op

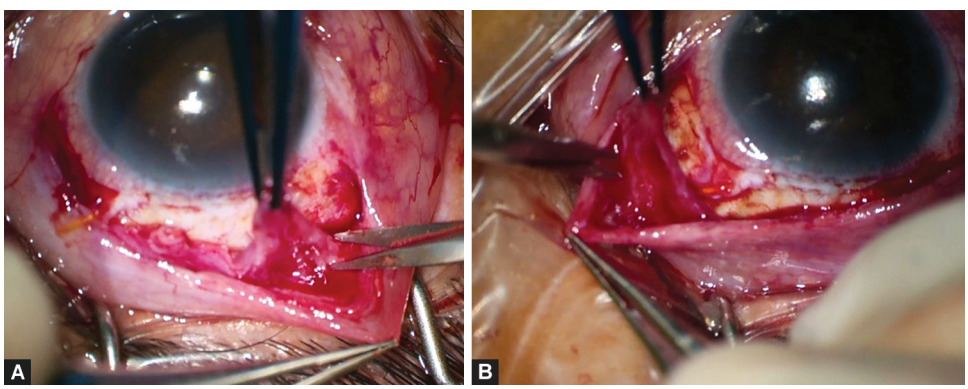
The surgery was conducted in accordance with the tenets of the World Medical Association's Declaration of Helsinki, and informed consent for the surgical approach was obtained.

Conjunctival peritomy was performed at the limbus followed by blunt dissection to expose the XEN implant, while gentle cautery was applied to maintain hemostasis.

After exposing the XEN, 0.1 mL of trypan blue 0.1% (VisionBlue, DORC International, BV Zuidland, Netherlands) was injected into the anterior chamber (AC) to visualize the patency of the device. Unfortunately, no percolation was observed. Even high-pressure injection through the internal lumen with balanced salt solution (BSS), aimed at restoring internal flow, was unsuccessful. The XEN63 device has a lumen of 63 µm, whereas 10-0 nylon has a lumen of 20 µm. A 10-0 nylon probe was used to probe the XEN lumen until theoretically reaching the internal lumen (Vision Blue dramatically reduces visibility in the AC). Its removal revealed slow percolation of colored aqueous humor (Figs 4 and 5).



Figs 2A and B: (A) XEN subconjunctival implant in superonasal site; (B) Subconjunctival injection of mitomycin 0.2 mg/mL

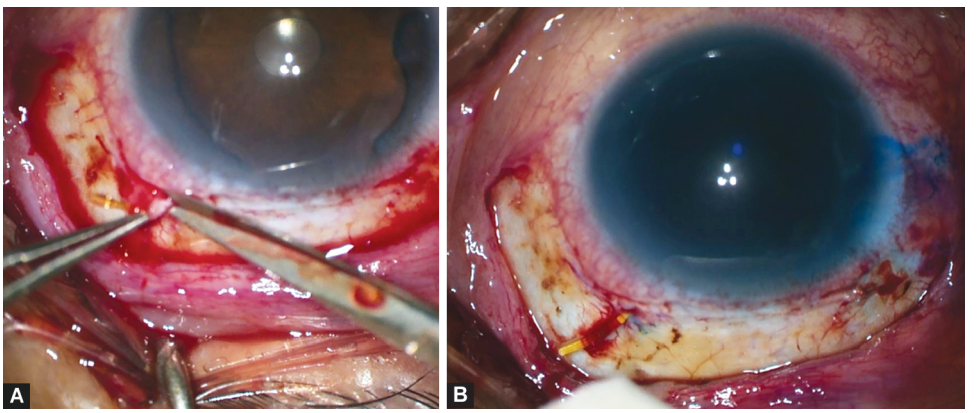


Figs 3A and B: (A) Removal of subconjunctival fibrosis and scar tissue; (B) Removal of Tenon's capsule

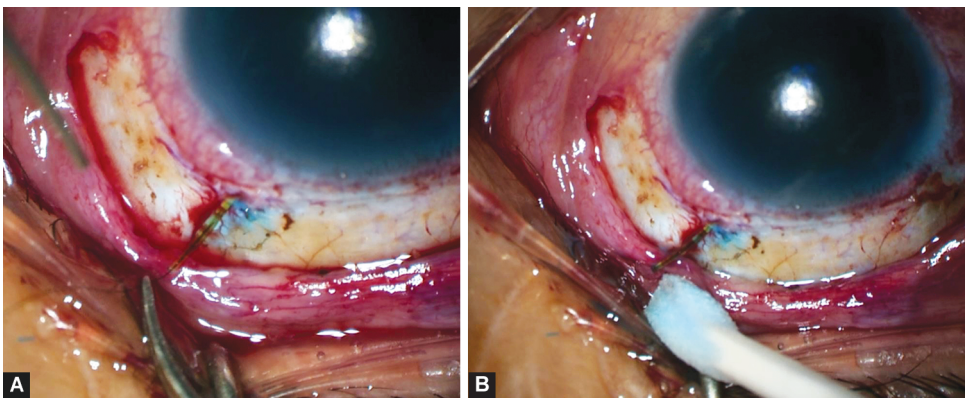
The AC was washed out with BSS, and a cohesive viscoelastic was injected to prevent any mitomycin reflux. A small sponge soaked in 0.2 mg/mL mitomycin was placed inside the conjunctival pocket for 3 minutes and then promptly removed. Following this step, the pocket was thoroughly irrigated with BSS, and the conjunctiva was closed using 8-0 vicryl sutures. The XEN implant was positioned on the scleral surface free from Tenon's tissue. After the surgical procedure, patients received subconjunctival steroid and antibiotic treatments, as depicted in Figures 6A and B.

Treatment with topical steroids is continued for a minimum period of 3 months following revision surgery, starting with six drops daily.

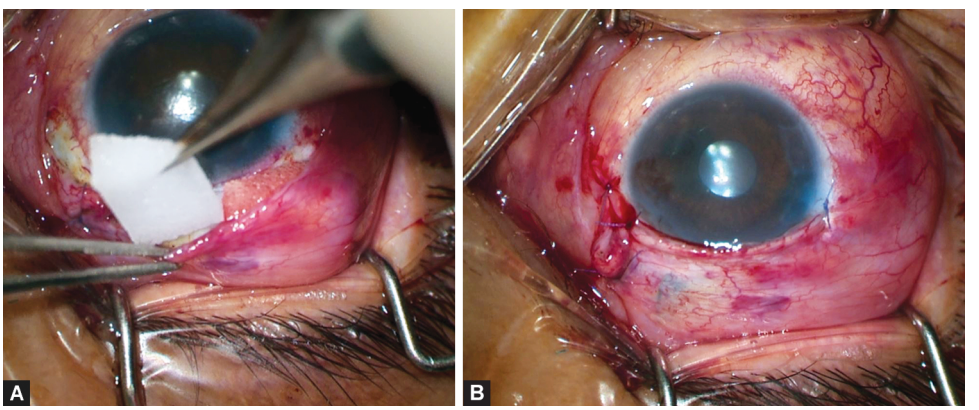
Postoperative examinations at 1, 3, 7, 14, 21, and 30 days revealed a patent XEN stent with IOP measuring 5 mm Hg, accompanied by a diffuse bleb and no observed complications. At 3 months, the



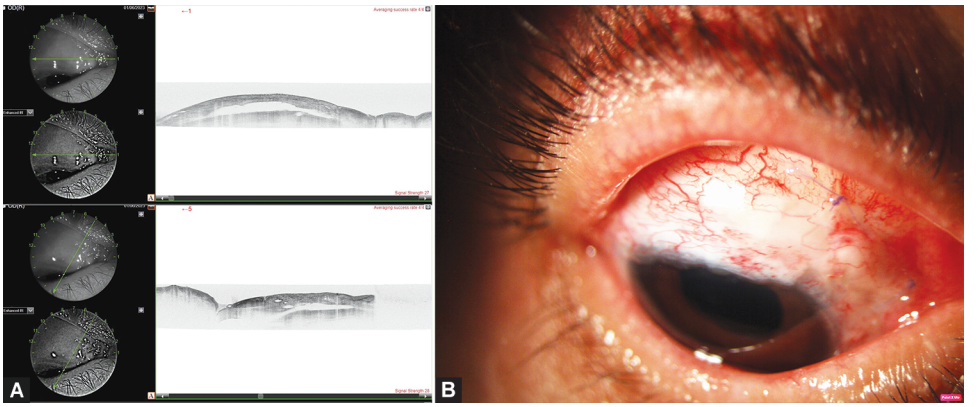
Figs 4A and B: (A) Careful dissection of subconjunctival fibrosis in the area of stent implantation; (B) Patency test of the XEN with trypan blue



Figs 5A and B: (A) Insertion of the 10-0 nylon suture inside the lumen of the XEN and probing of the device; (B) With unblocking of the obstruction and percolation of aqueous humor labeled with trypan blue



Figs 6A and B: (A) MMC applied using a delicate sponge tip (K-sponge, Katena Products Inc., Denville, New Jersey); (B) Suturing of the conjunctiva with a normally positioned XEN



Figs 7A and B: (A) Optical coherence tomography performed with AS-OCT DRI Triton (Topcon Medical Systems, Oakland, New Jersey) demonstrated a well-functioning filtering bleb 1 month after the XEN implantation; (B) Anterior segment photography shows a raised, diffuse and normovascularized bleb

pressure remained stable at 8 mm Hg without the need for IOP-lowering drops, and a diffuse bleb was still present (Figs 7A and B).

Discussion

This case report explores the potential occurrence of lumen obstruction within the XEN63 device, emphasizing the opportunity to reinstate its functionality through an ab-externo revision technique employing a 10-0 nylon probe. This approach should be considered as a less invasive option before contemplating more aggressive surgical interventions and can be extended to other glaucoma devices.

Uveitic glaucoma presents a formidable challenge, as it manifests as glaucoma resulting from inflammation. The higher risk of surgical failure primarily stems from the presence of persistent inflammation and structural alterations within the eye, which are particularly pronounced in uveitic patients.

Consequently, uveitic glaucoma necessitates often surgery.[5]

Trabeculectomy and shunt implants are associated with an increased risk of postoperative complications in uveitic eyes,[6–8] while studies on microinvasive glaucoma surgery (MIGS) suggest a safer profile.[9,10]

The XEN gel implant, a hydrophilic collagen MIGS device, is 6 mm long with an external diameter of 150 µm. It offers two internal lumen options: one measuring 45 µm and the newer one measuring 63 µm.[11] XEN has shown a similar safer profile in terms of complications in uveitic eyes and has been demonstrated to be an effective treatment option for IOP control in 83.3% of the population, with 62.5% of eyes requiring no medication for a minimum of 12 months.[12]

XEN63 has been recently used in uveitic glaucoma,[13] and so, it was proposed to our patients with uncontrolled IOP despite maximal medical therapy. It was also performed in conjunction with cataract surgery to improve vision and quality of life.

Unfortunately, despite the use of XEN63 and dexamethasone 0.1% treatment, IOP increased, and a flat bleb developed after 1 month, indicating a high probability of zero or low flow passing through the device. This failure of IOP reduction was likely influenced by a combination of factors, including the reduction of dexamethasone 0.1% frequency to six times a day due to challenging patient compliance, the additional inflammation resulting from the phaco procedure, and the pro-inflammatory baseline of a uveitic eye.

As reported by Sng et al., uveitic patients undergoing XEN 45 implantation may require needling under slit lamp in up to 41.7% of cases, and up to 20.8% may require bleb revision in a surgical setting.[12] For this reason, the possibility of failure was thoroughly explained to the patient before surgery. We encourage readers to allocate additional time for such discussions, especially in cases involving "pro-inflammatory" conditions.

If the obstruction is in the AC or in the internal part of the device an AC washout, a YAG laser treatment[14,15] or an ab-interno revision[16,17] could be performed. The typical range of laser energy used ranges between 0.3 and 1.2 mJ. In our case, a Gonio lens (MagnaView, Ocular Instruments) was used to align the laser beam in an anterior axial position relative to the stent's lumen. Energy was incrementally increased until a small cavitation bubble was generated just before the tip of the lumen. In our case, this occurred at an energy level of 0.6 mJ, and a total of five laser shots were administered. Unfortunately, this treatment did not result in a discernible reduction in IOP. A potential explanation for this lack of response could be the absence of detectable debris obstructing the terminal portion of the device, as verified under slit-lamp examination. However, considering the theoretical possibility of achieving adequate power to restore flow through the device, and the safety of the treatment at low power settings, we decided to proceed with the procedure.

When the obstruction is suspected to be external to the device, involving the conjunctiva, Tenon's capsule, blood, or fibrotic tissue, needling may be considered as part of the management strategy. In our case, this approach was unsuccessful (Figs 4A and B).

Consequently, the next step involved opening the bleb. Typically, these blockages occur due to the formation of fibrotic tissue that encapsulates the Tenon's capsule, covering the entire external part of the device's lumen. In our case, however, this was not the underlying issue. Even after freeing the XEN stent from the Tenon's capsule, there was no evidence of percolation. This case presentation suggests that a deeper obstruction within the device was the primary cause of the problem.

To enhance internal flow and potentially dislodge the internal obstruction, BSS was injected into the AC using a high-flow approach. A cannula inserted through the side port was used to increase pressure and counteract the possible blockage. Unfortunately, despite this effort, there was no sign of percolation.

The primary obstruction was ultimately cleared through gentle probing with a 10-0 suture, as demonstrated in the accompanying video (Video 1).

While the use of a suture within a tubular device is not unprecedented, such as the work by Lupardi et al.,[18] who employed a suture to reduce the internal lumen of a Preserflo device to prevent potential hypotony, this case represents the first documented instance of using a suture for probing within a tubular device suspected of obstruction.

There are several reasons why we believe that probing with a 10-0 nylon has been superior to flushing BSS in our case:

- Mechanical clearance: Probing with a nylon 10-0 suture involves physically removing any obstructions or blockages within the tube's internal lumen. This method directly addresses the issue of potential blockages, such as fibrin or tissue debris, that might accumulate within the tube over time. In contrast, flushing with BSS relies on the force of the solution to clear the tube, which may not be as effective in dislodging or removing stubborn obstructions.
- Precise targeting: Probing with nylon 10-0 allows for precise targeting of any blockages or restrictions within the tube. The surgeon can identify and gently maneuver the suture through the lumen to clear specific areas of concern. Flushing with BSS may not provide the same level of precision and may not effectively reach all areas within the tube.
- Flushing of the XEN implant with an irrigation cannula is challenging due to the small lumen and its flexibility, whereas using nylon 10-0 can be easily inserted even with a one-hand technique.

Some colleagues reported the possibility of cutting the very end of the XEN63 to reestablish the internal flow.[17] Unfortunately, this induce a change in the Poiseuille's law: a shorter implant has decreased resistance causing an increase in flow,[19] determining the alteration of the fluid dynamics of the device. This can be avoided by possibly using nylon to mechanically open the lumen.

Certainly, if probing does not work to reestablish the flow, cutting the very end of the implant, using a second XEN, or proceeding to standard glaucoma surgery could be a wise choice.

Conclusion

We presented a case in which the blockage of the device was located deep within the lumen, and conventional methods such as needling, YAG laser treatment, Tenon's removal, and BSS flushing proved ineffective. Considering ab externo revision with a 10-0 nylon probe to address XEN gel stent occlusion, especially in uveitic patients, may serve as an effective treatment option prior to resorting to more invasive surgical procedures. Moreover, the concept of using nylon sutures for probing could potentially be extended to other devices when achieving patency is challenging, offering an alternative means to enhance flow before considering more invasive interventions.

Supplementary Material

The supplementary video 1 is available online on the website of www.jocgp.com

Video 1: The video shows the application of the probing technique in the case of intraluminal obstruction of XEN63

References

1. Kok H, Barton K. Uveitic glaucoma. Ophthalmol Clin North Am 2002;15(3):375–387, viii. DOI: 10.1016/s0896-1549(02)00028-7
2. Rigo J, Castany M, Banderas S, et al. Possible intraluminal obstruction of the XEN45 gel stent observed with anterior segment optical coherence tomography. J Glaucoma 2019;28(12):1095–1101. DOI: 10.1097/IJG.0000000000001351
3. Kim Y, Lim SH, Rho S. Bleb analysis using anterior segment optical coherence tomography and surgical predictors of XEN gel stent. Transl Vis Sci Technol 2022;11(2):26. DOI: 10.1167/tvst.11.2.26
4. Hasan SM, Theilig T, Tarhan M, et al. Bleb morphology using optical coherence tomography: after primary implantation of XEN gel stent and open conjunctival revision. Ophthalmologie 2023;120(5):529–537. DOI: 10.1007/s00347-022-01764-7
5. Magliyah MS, Badawi AH, Alshamrani AA, et al. The effect of perioperative uveitis control on the success of glaucoma surgery in uveitic glaucoma. Clin Ophthalmol 2021;15:1465–1475. DOI: 10.2147/OPTH.S301648
6. Vera V, Ahmed I, Stalmans I, et al. Gel stent implantation—recommendations for preoperative assessment, surgical technique, and postoperative management. US Ophthalmic Rev 2018;11(1):38–46. DOI: 10.17925/USOR.2018.11.1.38
7. Zacharia PT, Deppermann SR, Schuman JS. Ocular hypotony after trabeculectomy with mitomycin C. Am J Ophthalmol 1993;116(3):314–326. DOI: 10.1016/s0002-9394(14)71349-2
8. Kalinina Ayuso V, Scheerlinck LM, de Boer JH. The effect of an Ahmed glaucoma valve implant on corneal endothelial cell density in children with glaucoma secondary to uveitis. Am J Ophthalmol 2013;155(3):530–535. DOI: 10.1016/j.ajo.2012.09.001
9. Sng CC, Barton K. Mechanism and management of angle closure in uveitis. Curr Opin Ophthalmol 2015;26(2):121–127. DOI: 10.1097/ICU.0000000000000136.
10. Sng CC, Ang M, Barton K. Uveitis and glaucoma: new insights in the pathogenesis and treatment. Prog Brain Res 2015;221:243–269. DOI: 10.1016/bs.pbr.2015.06.008
11. Vera VI, Horvath C. XEN gel stent: the solution designed by AqueSys. In: Samples JR, Ahmed IIK (Eds). Surgical Innovations in Glaucoma. New York: Springer Science + Business Media; 2014. pp. 189–198.
12. Sng CC, Wang J, Hau S, et al. XEN-45 collagen implant for the treatment of uveitic glaucoma. Clin Exp Ophthalmol 2018;46(4):339–345. DOI: 10.1111/ceo.13087
13. Serrar Y, Rezkallah A, Kodjikian L, et al. XEN® 63 gel stent to treat a refractory uveitic glaucoma: a case report. Eur J Ophthalmol 2023;33(4):NP32–NP36. DOI: 10.1177/11206721221109199
14. Fellman RL, Grover DS, Smith OU, et al. Rescue of failed XEN-45 gel implant by Nd:YAG shock wave to anterior chamber tip to dislodge hidden intraluminal occlusion. J Glaucoma 2021;30(7):e338–e343. DOI: 10.1097/IJG.0000000000001847
15. Rho S, Lim SH. Combined argon laser peripheral iridoplasty and Nd:YAG laser shock wave therapy for recurrent XEN gel stent obstruction due to iris incarceration: a case report. Medicine (Baltimore) 2021;100(29):e26652. DOI: 10.1097/MD.0000000000026652
16. Pinto Ferreira N, Abegão Pinto L, Marques-Neves C. XEN gel stent internal Ostium occlusion: Ab-Interno revision. J Glaucoma 2017;26(4):e150–e152. DOI: 10.1097/IJG.0000000000000625
17. Tatti F, Gentile P, Mangoni L, et al. Xen45 gel stent ab interno trimming for ostium occlusion: case report. BMC Ophthalmol 2021;21(1):446. DOI: 10.1186/s12886-021-02207-8
18. Lupardi E, Laffi GL, Ciardella A, et al. Ab-externo intraluminal stent for prolonged hypotony and choroidal detachment after Preserflo implantation. Eur J Ophthalmol 2023;33(5):NP63–NP66. DOI: 10.1177/11206721221137166
19. Olivari S, Cutolo CA, Negri L, et al. XEN implant fracture during needling procedure. J Glaucoma 2019;28(12):1086–1089. DOI: 10.1097/IJG.0000000000001360