Fibrin Pupillary-block Glaucoma after Uneventful Phacovitrectomy in a Patient with Proliferative Diabetic Retinopathy (PDR): A Case Report

Fahsiri Tavonvunchai, M.D., Nantinee Vilainerun, M.D., Puntanarach Gacivut, M.D.

Ophthalmology Department, Chulabhorn Hospital, Chulabhorn Royal Academy, Bangkok, Thailand

Background: Fibrin pupillary-block glaucoma is an uncommon complication after phacoemulsification or vitrectomy. Various treatment modalities relieving fibrin pupillary-block have been reported, such as intracameral recombinant tissue plasminogen activator (rTPA), argon–neodymium: YAG (Nd:YAG) laser iridotomy, Nd:YAG laser membranotomy, and medical dilation.

Objective: To report a patient with proliferative diabetic retinopathy (PDR) who developed fibrin pupillary-block glaucoma after uneventful phacovitrectomy and was successfully treated with Nd:YAG laser membranotomy.

Methods: Retrospective case report.

Results: The patient was a 59-year-old Thai male with PDR, epiretinal membrane and tractional macular edema in his left eye. Combined phacoemulsification with pars plana vitrectomy (PPV) was performed. On postoperative day 7, the patient presented with blurred vision from corneal microcystic epithelial edema associated intraocular pressure (IOP) spike due to the presence of fibrin membrane obstructing the pupil opening and was diagnosed with fibrin pupillary-block glaucoma. Nd:YAG laser membranotomy was performed and resulted in complete resolution of pupillary block.

Conclusion: Laser Nd:YAG membranotomy provides safe and effective resolution of fibrin pupillary-block glaucoma.

Keywords: fibrin pupillary-block glaucoma, phacovitrectomy surgery, argon-neodymium:YAG (Nd:YAG) laser membranotomy, proliferative diabetic retinopathy, post-operative inflammation

EyeSEA 2024;19(1):8-11

Introduction

Phacoemulsification with conjunction with PPV is used to treat patients with diabetic retinopathy, with the advantage of preventing visual disturbance from post-vitrectomy cataract.[1,2] Studies showed that inflammatory response occurs more frequently in combination procedure than in vitrectomy-alone.[2,3] PDR has been reported as a factor influencing postoperative synechiae after combined surgery.[4] Breakdown of blood-aqueous barrier caused by intraocular surgery incorporated with microangiopathy in PDR may contribute to postoperative significant anterior chamber reaction, fibrin formation, and posterior synechiae.[2,5] There were reports of fibrin pupillary-block glaucoma as an uncommon complication after phacoemulsification or vitrectomy.[6-8] We reported a case successfully treated with Nd:YAG laser membranotomy in a patient with PDR who underwent phacovitrectomy.

Correspondence to:
Fahsiri Tavonvunchai, *Ophthalmology Department, Chulabhorn Hospital, Chulabhorn Royal Academy, Bangkok, Thailand,*
E-mail: fahsiri1997@gmail.com
Received : August 28th, 2023
Accepted : April 24th, 2024
Published : June 30th, 2024

Case information

The patient was a 59-year-old Thai male with type 2 diabetes mellitus, hypertension, dyslipidemia, and chronic kidney disease stage V. He had nuclear sclerosis, inactive PDR, and epiretinal membrane with tractional macular edema in his left eye. Phacoemulsification with intraocular lens implantation, PPV with membrane peeling, and intravitreal Aflibercept was performed. On postoperative day 1, the visual acuity was 20/80, the anterior chamber activity was 2+ cells, and the intraocular pressure was 18 mmHg. The patient was prescribed topical 1% prednisolone acetate 4 times/day, moxifloxacin eye drops 4 times/day, and neomycin/polymyxin/dexamethasone eye ointment once daily.

On postoperative day 7, he presented with blurred vision; VA 20/150, IOP of 32 mmHg, shallow anterior chamber with cell 3+, plasmoid reaction, and fibrinous membrane adhering across pupillary margin. Gonioscopy showed closed angles 360 degrees. The anterior segment optical coherence tomography (AS-OCT) showed a shallow anterior chamber with pupillary block from interpupillary membrane. The posterior chamber was deep with a large space between iris and IOL. (figure 1) Thirty-nine applications of 1mJ argon–neodymium:YAG (Nd:YAG) laser membranotomy was performed on the same day with subsequent complete resolution of the pupillary block. After laser membranotomy, AS-OCT showed deepening of the anterior chamber with disrupted fibrin membrane. (figure 2) He was then prescribed topical steroid 6 times/day with slow tapering in 1.5 months. On the following day, a contracted plasmoid was seen by slit-lamp examination, and the anterior chamber showed inflammatory activity with 2+ cells. During the follow-up period, the anterior chamber remained deep and IOP remained normal.

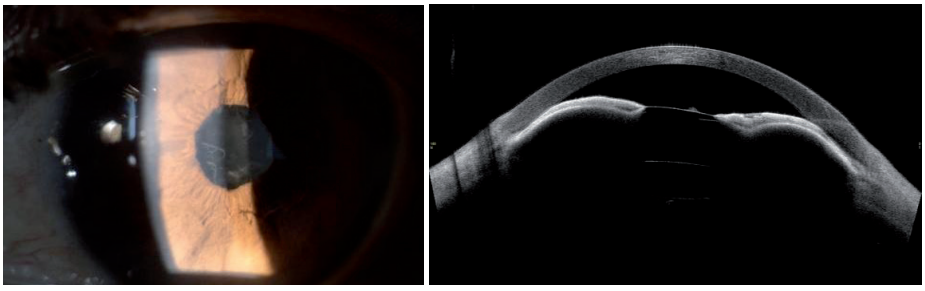

Figure 1: *Left:* Fibrin membrane is seen across the pupil. *Right:* AS-OCT confirmed membrane across pupil with IOL. The posterior chamber is deep and the IOL is displaced posteriorly (arrow).

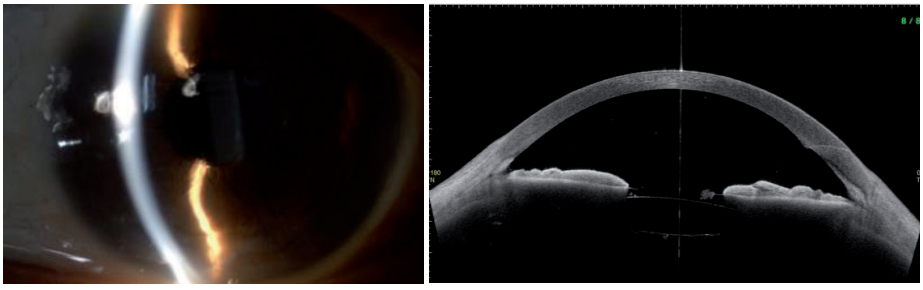

Figure 2: *Left:* After Nd:YAG laser membranotomy, the fibrin resolved, and the anterior chamber deepened. *Right:* AS-OCT showed disrupted membrane with deep anterior chamber.

Discussion

Fibrin pupillary-block is caused by an occlusion of the pupils with inflammatory membranes, resulting in a redirection of fluid into a 'third space' cavity between the iris and intraocular lens, subsequently causing a bowing of the iris.[7] The predisposing factors that heighten the development of fibrin membranes in this patient include undergoing a combined surgery and having multiple systemic diseases, especially diabetes with PDR.[8] Studies have found that combined phacovitrectomy surgeries lead to stronger inflammatory outcomes, compared to PPV-only surgeries.[2,4] According to Liu *et al*., postoperative aqueous flare values in diabetic patients with PDR were significantly higher than patients without diabetes mellitus, or diabetic patients with non-proliferative retinopathy.[9]

The mechanism behind fibrin development and strong inflammatory reaction in patients with diabetes is due to an interruption of the blood retinal barrier (BRB).[10,11] The compromised BRB allows the circulating immune cells and serum proteins to infiltrate the retina, activating the microglial and complement cells. Activated microglia and infiltrating immune cells release pro-inflammatory cytokines, such as IL-1, IL-6, and TNFα, and chemokines, such as MCP-1, ROS, and VEGF provoking a prolonged and excessive inflammatory response.[10,12]

Since fibrin pupillary-block is a rare complication, treatment is not well established. Yoshino *et al*. injected 25 μg of intracameral tissue plasminogen activator (tPA), which lysed fibrin membrane in a patient with pupillary block glaucoma.[8] Bennett *et al*. reported a case treated with topical pupillary dilation, which successfully broke the membrane pupillary block within 30 minutes.[13] Although fibrinolysis of the membrane with pupillary dilation has been reported as a safe, fast, and minimally invasive strategy, however, it may be not effective in all cases.

In high-risk patients, aggressive topical steroid treatment may be beneficial in decreasing postoperative inflammation. Lahey *et al*. found positive results with minimal complications after prescribing alternate prednisolone acetate with neomycin-polymyxin B-dexamethasone eye drops every 2 hours during waking hours for the first 3 weeks.[2] In a case series, 3 patients with diabetes and hypertension who had phacoemulsification only, developed fibrin pupillary-block glaucoma approximately 2 weeks after surgery when the frequency of topical steroids was decreased from every 3 hours to only 3 to 4 times a day.[6] This suggests that for high-risk patients, intensive topical steroids should be continued for at least 2 to 3 weeks after surgery, and the frequency adjusted according to the severity of inflammation.

In our case, the patient was prescribed with topical 1% prednisolone acetate for only 4 times/day after a phacovitrectomy surgery, which may not be sufficient to control the severe postoperative inflammation.[6] On postoperative day 7 when the patient developed fibrin pupillary-block glaucoma, Nd:YAG laser membranotomy was performed with an increase in the frequency and duration of topical steroids to 6 times/day with slow tapering in 1.5 months. The patient responded well to the treatment and the fibrin pupillary-block glaucoma resolved.

Conclusion

Combined phacovitrectomy in patients with PDR may induce significant anterior chamber reaction. Appropriate control of postoperative inflammation with aggressive topical steroid is suggested. Laser Nd:YAG membranotomy provides a safe and effective procedure to treat fibrin pupillary-block glaucoma.

References

1. Demetriades AM, Gottsch JD, Thomsen R, et al. Combined phacoemulsification, intraocular lens implantation, and vitrectomy for eyes with coexisting cataract and vitreoretinal pathology. *Am J Ophthalmol*. 2003;135(3):291-296. 2. Lahey JM, Francis RR, Kearney JJ. Combining phacoemulsification with pars plana vitrectomy in patients with proliferative diabetic retinopathy. *Ophthalmology*. 2003;110(7):1335-1339.
3. Treumer F, Bunse A, Rudolf M, Roider J. Pars plana vitrectomy, phacoemulsification and intraocular lens implantation. Comparison of clinical complications in a combined versus two-step surgical approach. *Graefe's Archive for Clinical and Experimental Ophthalmology*. 2006;244(7):808-815.

4. Park SP, Ahn JK, Lee GH. Morphologic changes in the anterior segment after phacovitrectomy for proliferative diabetic retinopathy. *J Cataract Refract Surg*. 2009;35(5):868-873.
5. Occhiutto ML, Freitas FR, Maranhao RC, Costa VP. Breakdown of the Blood-Ocular Barrier as a Strategy for the Systemic Use of Nanosystems. *Pharmaceutics*. 2012;4(2):252-275.
6. Khor WB, Perera S, Jap A, Ho CL, Hoh ST. Anterior segment imaging in the management of postoperative fibrin pupillary–block glaucoma. *J Cataract Refract Surg*. 2009;35(7):1307-1312.
7. Khan S, Elashry M. The Nd:YAG laser as first-line treatment for fibrin pupillary-block glaucoma following uncomplicated cataract surgery. *Oxf Med Case Reports*. 2019;2019(1).
8. Yoshino H, Seki M, Ueda J, Yoshino T, Fukuchi T, Abe H. Fibrin membrane pupillary-block glaucoma after uneventful cataract surgery treated with intracameral tissue plasminogen activator: a case report. *BMC Ophthalmol*. 2012;12(1):3.
9. Liu Y, Luo L, He M, Liu X. Disorders of the blood-aqueous barrier after phacoemulsification in diabetic patients. *Eye*. 2004;18(9):900-904.
10. Amorim M, Martins B, Fernandes R. Immune Fingerprint in Diabetes: Ocular Surface and Retinal Inflammation. *Int J Mol Sci*. 2023;24(12).
11. Liu Y, Luo L, He M, Liu X. Disorders of the blood-aqueous barrier after phacoemulsification in diabetic patients. *Eye*. 2004;18(9):900-904.
12. Xu H, Chen M. Diabetic retinopathy and dysregulated innate immunity. *Vision Res*. 2017;139:39-46.
13. Bennett S, Studsgaard A, Telinius N. Topical dilation as first-line treatment for fibrin membrane pupillary-block glaucoma following uncomplicated cataract surgery. *BMJ Case Rep*. 2023;16(4).