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Three cases of macular retinal detachment exacerbated during follow-up with myopic foveoschisis around myopic choroidal neovascularization☆,☆☆

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ABSTRACT

Purpose: Myopic choroidal neovascularization (CNV) and myopic traction maculopathy are major complications of pathologic myopia, and myopic foveoschisis (MF) is one of several symptoms that can be included under the general term "myopic traction maculopathy"; however, only a few cases will have MF around the myopic CNV. We report three cases with MF around myopic CNV that followed different clinical courses observed using swept-source optical coherence tomography.

Observations: Case 1 was a 69-year-old woman with an axial length of 29.71 mm, myopic CNV, and MF in the left eye. One month after intravitreal injection of ranibizumab (IVR), a macular retinal detachment (RD) expanded. Vitrectomy and gas tamponade were performed during month 2; the macular RD and MF resolved gradually thereafter. Case 2 was a 54-year-old man with an axial length of 30.59 mm, myopic CNV, and MF in the right eye; after IVR, a macular RD developed and gradually expanded until month 4; the RD and MF resolved spontaneously and resolved during month 8. Case 3 was a 66-year-old woman with an axial length of 28.63 mm, myopic CNV, and MF in the left eye. A macular RD expanded 1 month after a previous vitrectomy for MF; after intravitreal injection of aflibercept, the macular RD and MF resolved gradually in month 12. In all cases, the CNV was accompanied by subretinal fluid, and two of the three cases had outer lamellar holes.

Conclusion and Importance: The MF around the myopic CNV may lead to exacerbated MF and RD during follow-up, and the subretinal fluid caused by the CNV might facilitate MF progression. Since this condition is rare, further investigation of this entity is needed to determine appropriate management.

1. Introduction

Myopic choroidal neovascularization (CNV), one of the most serious complications in pathologic myopic eyes,[1,2] occurs in 5%–10% of highly myopic eyes and causes severe visual impairment without treatment.[3] The first-line treatment is anti-vascular endothelial growth factor (VEGF) therapy. Various clinical trials and review articles have reported favorable results in the short term; in the long term, the visual acuity (VA) tends to decline and challenges remain.[4–6]

Myopic foveoschisis (MF) is one of several manifestations that can occur under the umbrella term "myopic tractional maculopathy," and its classification based on the macular morphology and degree of progression has been reported.[1,7,8] The natural history of 3.9% of patients showed spontaneous resolution over a 3-year period, while 11.6% progressed, with the progression rate increasing with the stage of classification by the degree of progression.[9]

MF around the myopic CNV is rare; most previous mentions of MF around CNV are case reports, and the frequency reported by Shimada et al., who investigated a large number of cases, was 4 of 74 eyes (5.4%).[10–12] Those studies reported that three of four eyes had a macular retinal detachment (RD) after VEGF therapy, one eye had an exacerbated RD, and all eyes had an outer lamellar hole.[12] However, the optical coherence tomography (OCT) used by Shimada et al. was time-domain OCT, which has slightly lower resolution compared with the currently used mainstream swept-source OCT (SS-OCT). We report three cases with MF around the myopic CNV that followed different clinical courses observed using SS-OCT.

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2. Case reports

2.1. Case 1

A 69-year-old woman with an axial length of 29.71 mm presented to our institution because of visual acuity (VA) decline of 1-month duration in the left eye (best-corrected VA [BCVA] of the left eye, 20/100). Slit-lamp microscopy showed a retinal hemorrhage at the fovea; fluorescein angiography identified classic CNV. SS-OCT showed a hyperreflective area above the retinal pigment epithelium bulge at the fovea indicating classic CNV, a small amount of subretinal fluid adjacent to the CNV, and a MF around the CNV (Fig. 1A–E). Vitreous traction and an internal limiting membrane (ILM) detachment also were observed (Fig. 1F). One month after a ranibizumab intravitreal injection (IVR) (Lucentis, Genentech Inc., South San Francisco, CA), the macular RD and MF were exacerbated (Fig. 1G), followed by a pseudo-macular hole 2 months later (Fig. 1H). The BCVA of the left eye was 20/63 at 1 and 2 months. The patient underwent 25-gauge pars plana vitrectomy and cataract surgery, ILM peeling, and air tamponade to remove the vitreous and ILM traction, and the RD and MF gradually resolved over 8 months (Fig. 1I–K). The BCVA improved to 20/40. An outer lamellar hole was observed at month 1 (Fig. 1G). No additional anti-VEGF therapy was needed postoperatively during the follow-up period.

2.2. Case 2

A 54-year-old man with an axial length of 30.59 mm presented with the complaint of an enlarged visual field defect in his right eye. The BCVA of his right eye was 20/20. Slit-lamp microscopy showed a slight hemorrhage at the edge of the patchy atrophy, and fluorescein angiography visualized a classic CNV in the same area (Fig. 2A–E). SS-OCT showed the CNV and MF surrounding the CNV, with slight subretinal fluid adjacent to the CNV (Fig. 2E). An ILM detachment also was observed (Fig. 2F). The RD gradually expanded after IVR to its largest size at month 4 (Fig. 2G–J). The BCVA was 20/12. Despite the worsening appearance, vitrectomy was not attempted both because of the acceptable VA and the patient's preference. Thereafter, the RD and MF gradually resolved spontaneously by month 8 (Fig. 2K-N). The BCVA remained 20/12 even in month 8.

2.3. Case 3

A 66-year-old woman with an axial length of 28.63 mm presented with the chief complaint of difficulty with vision in her left eye for the previous 2 months. The BCVA of the left eye was 20/200. SS-OCT showed a hyperreflective area at the fovea with MF around it, although no hemorrhage was evident on slit-lamp microscopy (Fig. 3A, B, D). A small amount of subretinal fluid adjacent to the CNV also was observed on SS-OCT (Fig. 3B). Since the CNV was considered less active and the anti-VEGF therapy could worsen the retinal traction, the patient underwent 25-gauge pars plana vitrectomy and ILM peeling to eliminate the possibility of enhanced retinal traction with anti-VEGF therapy; at 1 month; a hemorrhage and exacerbated MF and RD were seen (Fig. 3E). The BCVA improved to 20/40. After an intravitreal injection of aflibercept (Eylea, Regeneron Pharmaceuticals, Tarrytown, NY), the RD and MF gradually improved and resolved at month 12 (Fig. 3F–I). The final BCVA was 20/25. An outer lamellar hole was observed during month 2 (Fig. 3C).

3. Discussion

Pathological myopia is a condition in which extension of the axial length is accompanied by myopia progression, which is complicated by various retinal diseases leading to VA deterioration.[1,13] Although myopic CNV or myopic tractional maculopathy including MF is a typical complication of pathologic myopia, few cases of MF around the myopic CNV have been reported.[1,7,8]

Panozzo and Mercani in 2004 defined myopic tractional maculopathy and included the following conditions: MF, RD, lamellar macular holes, and full-thickness macular holes with/without RD.[14] Several researchers have reported myopic tractional maculopathy classifications.[7,9,15] Although the speed varies among reports, all have reported that myopic tractional maculopathy is progressive; initially it is only a split in the retina and is followed by a macular RD, which develops

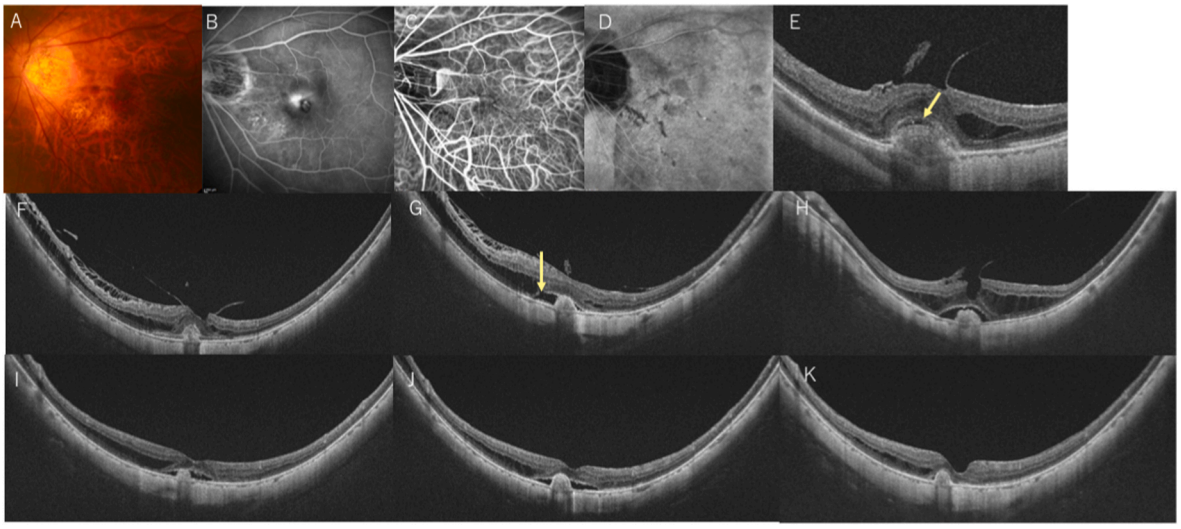

Fig. 1. A 69-year-old woman with an axial length of 29.71 mm, myopic choroidal neovascularization (CNV) and myopic foveoschisis (MF) in her left eye. (A–E) A fundus photograph (A), fluorescein angiography (B), indocyanine green angiography (C, early phase; D, late phase), and optical coherence tomography (OCT) (E) show myopic CNV at the macula before anti-vascular endothelial growth factor therapy. A magnified OCT image before treatment shows a slight amount of subretinal fluid (arrow) (E). (F–K) OCT images obtained before treatment (F) to 1 (G), 2 (H), 3 (I), 5 (J), and 8 months (K) after treatment. One month after intravitreous injection of ranibizumab (IVR), a macular retinal detachment (RD) and MF worsened (G), and in month 2, a pseudo-macular hole developed and vitrectomy was performed (H), after which the macular RD and MF gradually resolved (H–K). The vitreous traction and inner limiting membrane detachment were present before the IVR injection was administered (F). One month after IVR, OCT shows an outer lamellar hole (arrow) (G). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

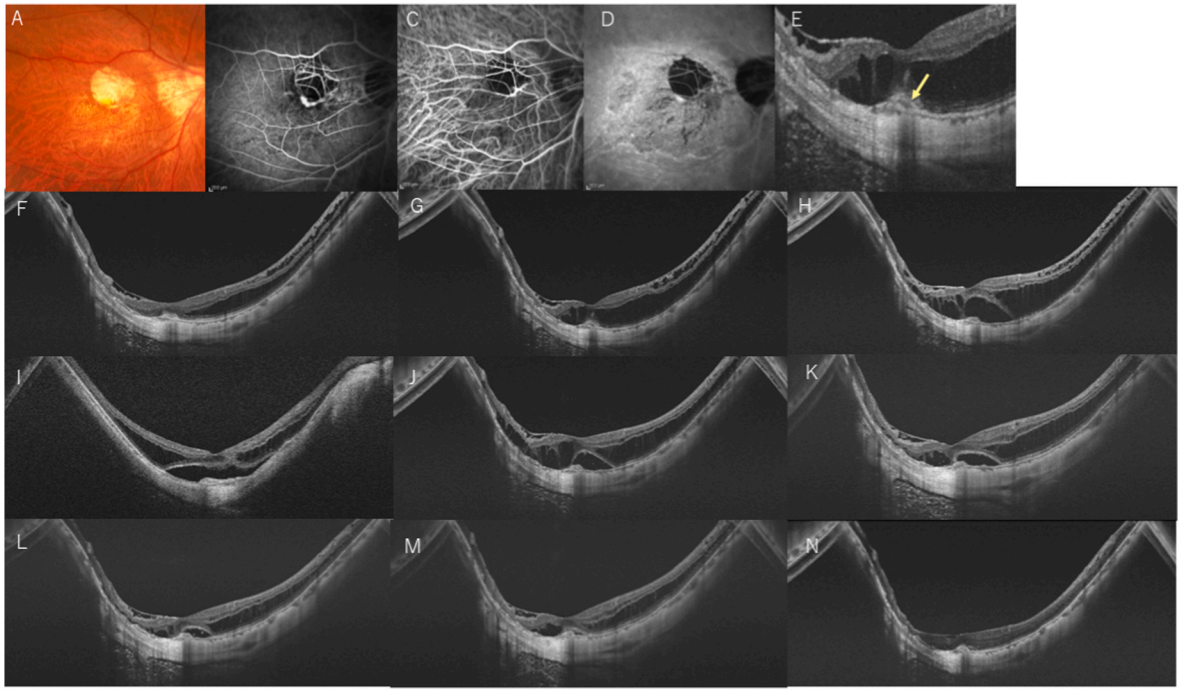

Fig. 2. A 54-year-old man with an axial length of 30.59 mm, myopic choroidal neovascularization (CNV) and myopic foveoschisis (MF) in his right eye. (A–E) A fundus photograph (A), fluorescein angiography (B), indocyanine green angiography (C, early phase; D, late phase), and optical coherence tomography (OCT) (arrow) (E) show myopic CNV at the macula before anti-vascular endothelial growth factor therapy. A magnified OCT image before treatment shows a slight amount of subretinal fluid (arrow) (E). (F–N) OCT images obtained before treatment (F) to 1 (G), 2 (H), 3 (I), 4 (J), 5 (K), 6 (L), 7 (M), and 8 months (N) after treatment. After intravitreal injection of ranibizumab (G–I), the macular retinal detachment and MF gradually worsened but then gradually resolved spontaneously (J–N). The inner limiting membrane detachment was present before the IVR was administrated (F). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

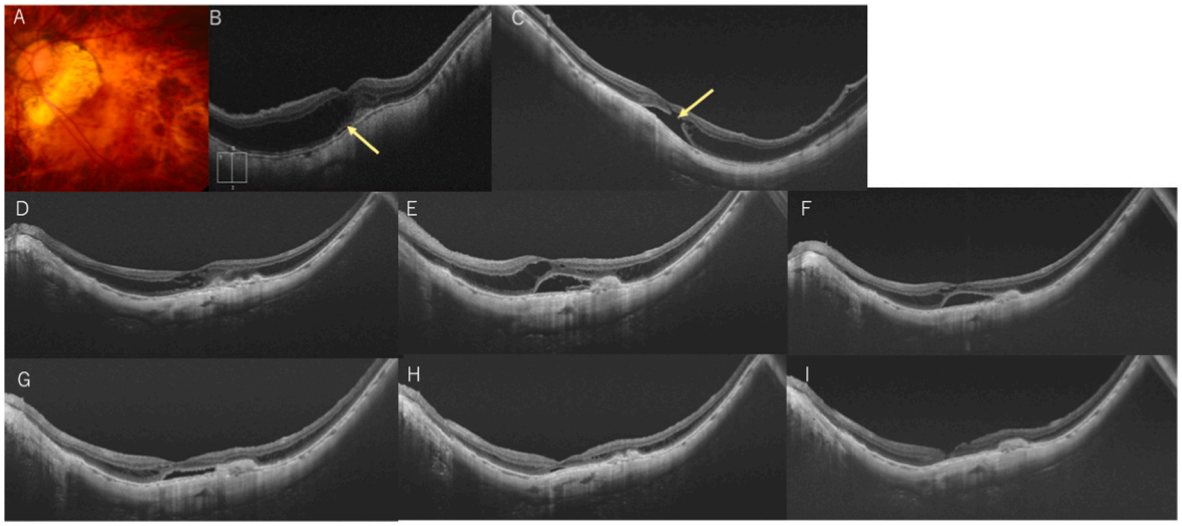

Fig. 3. A 66-year-old woman with an axial length of 28.63 mm, myopic choroidal neovascularization (CNV) and myopic foveoschisis (MF) in her left eye. (A, B) A fundus photograph (A) and optical coherence tomography (OCT) (arrow) (B) show myopic CNV at the macula before treatment. OCT images obtained before treatment (B) show a small amount of subretinal fluid and OCT after 2 months of treatment (C) show an outer lamellar hole (arrow). (D–I) OCT images from before treatment (D) to 1 (E), 2 (F), 3 (G), 4 (H), and 12 months (I) after treatment. One month after vitrectomy, a macular retinal detachment (RD) worsened and a hemorrhage is observed (E). An intravitreal injection of aflibercept was administered, after which the macular RD and MF gradually resolved (F–I).

gradually with/without a macular hole.[7,9] The pathogenesis of myopic tractional maculopathy involves multiple factors, and it is postulated that retinal separation is caused by centripetal traction due to the vitreous and ILM and centrifugal traction due to axial length elongation and posterior staphyloma.[1,7,8,16] Although treatment for myopic tractional maculopathy has not been established, the purpose of the treatment would be to reduce or eliminate traction. Vitrectomy and macular buckling usually indicate severe myopic tractional maculopathy, although the combination of ILM peeling, ILM sparing, and gas tamponade is controversial.[1,7,8,16]

Typical myopic CNV is small, classic CNV that appears on OCT as a hyperreflective lesion above the retinal pigment epithelium with a small

amount of subretinal fluid.[1,2,17] The first-line treatment is anti-VEGF therapy, usually administered as one injection and then pro re nata, in contrast to age-related macular degeneration, which is treated with three loading doses.[1,2,17]

The current cases all had MF around the myopic CNV and an exacerbated macular RD during follow-up. Although the exact mechanism is unknown, three hypotheses are considered.

The first postulated mechanism is an increase in vitreous traction caused by anti-VEGF therapy. Previous case studies have reported a macular hole or macular hole RD after anti-VEGF therapy for myopic CNV.[10–12,18] Veloso et al. reported that a posterior vitreous detachment after anti-VEGF therapy is rare in eyes with age-related macular degeneration.[19] In case 3, a macular RD worsened after vitrectomy and resolved slowly after anti-VEGF therapy in the absence of vitreous. The first hypothesis is, therefore, slightly less tenuous; however, the possibility that anti-VEGF therapy increased vitreous traction in our cases cannot be excluded, since the vitreous properties and susceptibility to the posterior vitreous detachment may differ between highly myopic eyes and those with age-related macular degeneration with emmetropia.[20,21]

The second postulated mechanism is an outer lamellar hole. Shimada et al. reported cases of MF around the myopic CNV in four of 74 (5.4%) eyes with myopic CNV, and in all cases, a macular RD occurred or worsened after anti-VEGF therapy and time-domain OCT showed an outer lamellar hole.[12] Similarly, outer lamellar holes were seen on SS-OCT in two of the three current cases.[9] We reported previously that patients with MF with an outer lamellar hole (ellipsoid zone disruption) are at high risk of developing a macular hole RD, and macular RD and MF might communicate through the outer lamellar hole to exacerbate the RD.[22]

The third postulated mechanism is subretinal fluid accumulation. As discussed previously, myopic tractional maculopathy progresses from retinal splitting to a macular RD and accumulation of subretinal fluid, i.e., a slight macular RD caused by CNV, may disrupt the balance of centripetal and centrifugal traction, resulting in spontaneous progression of the myopic tractional maculopathy stage.[7,9] Since the subretinal fluid before treatment was negligible, it could only have been clearly delineated by SS-OCT.

The question then concerns management of the cases with MF around the myopic CNV. Unfortunately, since all of the current cases had different treatment courses, we cannot answer this question definitively. SS-OCT is excellent for detailed observation of the vitreous hyaloid,[23] and Case 1 demonstrated alterations in the vitreous traction before and after the development of a lamellar macular hole. In such cases, surgery should be considered, while in cases such as Case 2, in which no change is observed on SS-OCT at the vitreoretinal interface and the VA is stable, follow-up observation may be appropriate. In Case 3, a previous vitrectomy to remove vitreous traction may lead to a favorable outcome, although the possibility of excessive medical treatment also should be considered. Either way, it is important to follow the patient attentively and consider emergent surgery if the macular RD is exacerbated. Attention then should be paid to the vitreoretinal relationship using SS-OCT for that observation.

4. Conclusions

We reported three cases of MF around the myopic CNV with exacerbation of macular RDs during the follow-up period observed using SS-OCT. Regarding factors that exacerbate macular RDs, the current report indicates that increased vitreous traction caused by anti-VEGF therapy, the presence of outer lamellar holes as previously reported, and the subretinal fluid caused by CNV may be the causative factors. Clinicians should be aware of the possibility of exacerbation of macular RDs during the management of patients with MF around myopic CNV.

5. Patient consent

The patients provided verbal consent for publication of the case. This report does not contain personal information that could lead to the identification of the patients.

Ethics approval

This study adhered to the tenets of the Declaration of Helsinki. The Research Ethics Committee of Osaka University Hospital waived the requirement for ethics approval for the case report.

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Authorship

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

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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References

1. Ohno-Matsui K, Wu PC, Yamashiro K, Vutipongsatorn K, et al. IMI pathologic myopia. *Invest Ophthalmol Vis Sci*. 2021;62(5):5.
2. Cheung CMG, Arnold JJ, Holz FG, et al. Myopic choroidal neovascularization: review, guidance, and consensus statement on management. *Ophthalmology*. 2017;124(11):1690–1711.
3. Wong TY, Ferreira A, Hughes R, Carter G, Mitchell P. Epidemiology and disease burden of pathologic myopia and myopic choroidal neovascularization: an evidence-based systematic review. *Am J Ophthalmol*. 2014;157(1):9–25.e12.
4. Ikuno Y, Ohno-Matsui K, Wong TY, et al. Intravitreal aflibercept injection in patients with myopic choroidal neovascularization. *Ophthalmology*. 2015;122(6):1220–1227.
5. Wolf S, Balciuniene VJ, Laganovska G, et al. RADIANCE Study Group RADIANCE: a randomized controlled study of ranibizumab in patients with choroidal neovascularization secondary to pathologic myopia. *Ophthalmology*. 2014;121(3):682–692.e2.
6. Oishi A, Yamashiro K, Tsujikawa A, et al. Long-term effect of intravitreal injection of anti-VEGF agent for visual acuity and chorioretinal atrophy progression in myopic choroidal neovascularization. *Graefes Arch Clin Exp Ophthalmol*. 2013;251(1):1–7.
7. Parolini B, Palmieri M, Finzi A, Besozzi G, Frisina R. Myopic traction maculopathy: a new perspective on classification and management. *Asia Pac J Ophthalmol (Phila)*. 2021;10(1):49–59.
8. Frisina R, Gius I, Palmieri M, et al. Myopic traction maculopathy: diagnostic and management strategies. Results of a prospective study. *Clin Ophthalmol*. 2020;14:3699–3708.
9. Shimada N, Tanaka Y, Tokoro T, Ohno-Matsui K. Natural course of myopic traction maculopathy and factors associated with progression or resolution. *Am J Ophthalmol*. 2013;156(5):948–957.
10. Sun CB, Wang Y, Zhou S, et al. Macular hole retinal detachment after intravitreal Conbercept injection for the treatment of choroidal neovascularization secondary to degenerative myopia: a case report. *BMC Ophthalmol*. 2019;19(1):156.
11. Chung EJ, Koh HJ. Retinal detachment with macular hole following combined photodynamic therapy and intravitreal bevacizumab injection. *Kor J Ophthalmol*. 2007;21(3):185–187.
12. Shimada N, Ohno-Matsui K, Yoshida T, et al. Progression from macular retinoschisis to retinal detachment in highly myopic eyes is associated with outer lamellar hole formation. *Br J Ophthalmol*. 2008;92(6):762–964.
13. Jonas JB, Jonas RA, Bikbov MM, Wang YX, Panda-Jonas S. Myopia: histology, clinical features, and potential implications for the etiology of axial elongation. *Prog Retin Eye Res*. 2022 Dec 28, 101156. https://doi.org/10.1016/j.preteyeres.2022.101156 (Online ahead of print).
14. Panozzo G, Mercani A. Optical coherence tomography angiography findings in myopic traction maculopathy. *Arch Ophthalmol*. 2004;122(10):1455–1460.

15. Ruiz-Medrano TJ, Montero JA, Flores-Moreno I, et al. Myopic maculopathy: current status and proposal for a new classification and grading system (ATN). *Prog Retin Eye Res*. 2019;69:80–115.
16. Ikuno Y. Overview of the complications of high myopia. *Retina*. 2017;37(12): 2347–2351.
17. Ohno-Matsui K, Ikuno Y, Lai TYY, Gemmy Cheung CM. Diagnosis and treatment guideline for myopic choroidal neovascularization due to pathologic myopia. *Prog Retin Eye Res*. 2018;63:92–106.
18. Kannan NB, Sen S, Ramachandran O, Ramasamy K. Management of coexistent choroidal neovascular membrane and macular hole with serous detachment in a case of pathological myopia: challenges and dilemmas. *BMJ Case Rep*. 2020;13(3), e234051.
19. Veloso CE, Brocchi DN, Singh RP, Nehemy MB. Vitreomacular interface after anti-VEGF injections in diabetic macular edema. *Ophthalmology*. 2015;122(8): 1569–1572.
20. Itakura H, Kishi S, Li D, Nitta K, Akiyama H. Vitreous changes in high myopia observed by swept-source optical coherence tomography. *Invest Ophthalmol Vis Sci*. 2014;55(3):1447–1452.
21. Hayashi K, Manabe S, Hirata A, Yoshimura K. Posterior vitreous detachment in highly myopic patients. *Invest Ophthalmol Vis Sci*. 2020;61(4):33.
22. Sayanagi K, Ikuno Y, Soga K, Tano Y. Photoreceptor inner and outer segment defects in myopic foveoschisis. *Am J Ophthalmol*. 2008;145(5):902–908.
23. Liu JJ, Witkin AJ, Adhi M, et al. Enhanced vitreous imaging in healthy eyes using swept source optical coherence tomography. *PLoS One*. 2014;9(7), e102950.