

Case Report

Bacillary Layer Detachment in Diabetic Retinopathy: A Case Report

Abdulrahim Amini^a Hamid Riazi-Esfahani^{b,c} Kasra Cheraqpour^b
Mohammadkarim Johari^d Alireza Bolkheir^d Zahra Mahdizad^{b,c}
Fariba Ghassemi^{b,c}

^aDepartment of Ophthalmology, School of Medicine, Hormozgan University of Medical Sciences, Bandar Abbas, Iran; ^bEye Research Center, Farabi Eye Hospital, Tehran University of Medical Sciences, Tehran, Iran; ^cRetina and Vitreous Service, Department of Ophthalmology, Farabi Eye Hospital, Tehran University of Medical Sciences, Tehran, Iran; ^dDepartment of Ophthalmology, Poostchi Ophthalmology Research Center, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran

Keywords

Bacillary detachment · Diabetic retinopathy · Optical coherence tomography

Abstract

To our knowledge, this is the first report to describe bacillary layer detachment (BLD) in a patient with diabetic retinopathy treated with anti-vascular endothelial growth factor. We present the case of a 55-year-old diabetic female who was referred to our hospital complaining of decreased vision in her left eye for 2 weeks. Fundus examination of both eyes was compatible with diabetic retinopathy. Spectral-domain optical coherence tomography of the left eye showed a large dome-shaped cystic space with marginal septa, splitting the myoid zone, consistent with the BLD phenotype. A single dose of intravitreal bevacizumab injection was administered. After 4 weeks, BCVA was improved significantly with complete resolution of BLD. Underlying choroidal ischemia in patients with different vascular disorders like diabetes mellitus may lead to photoreceptor stress and BLD. This study adds to the growing literature, which describes BLD as a marker of fluid accumulation in relation to several macular diseases.

© 2023 The Author(s).
Published by S. Karger AG, Basel

Introduction

Bacillary layer detachment (BLD) is the dissociation of the myoid zone (MZ) from the ellipsoid component caused by an injury to the outer retina [1]. According to histological investigations, the inner photoreceptor layer at the level of the MZ is structurally weaker than

Correspondence to:
Fariba Ghassemi, fariba.ghassemi@gmail.com

the neighboring strong junctional complexes of the ellipsoid zone (EZ) and the external limiting membrane (ELM) [2]. BLD has been described in both non-infectious and infectious retinal diseases [2–6].

We present a case of a patient who was diagnosed with BLD in conjunction with diabetic retinopathy, which is a new finding to our knowledge. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see www.karger.com/doi/10.1159/000529314).

Case Presentation

A 55-year-old woman was referred to our clinic with the complaint of decreased vision in her left eye since 2 weeks ago. Her past medical history was positive for diabetes mellitus from 10 years ago with no past ocular history. The patient mentioned no history of any ocular surgery, panretinal photocoagulation, or intravitreal injection of anti-vascular endothelial growth factors (anti-VEGFs). At presentation, the best-corrected visual acuity of the right and left eyes were 20/20 (plano) and 20/200 (+2.00–0.50 × 70°), respectively. Slit-lamp examination of both eyes revealed normal anterior segment and vitreous. There were no cells or flare in the anterior chamber and no haze in the vitreous. Intraocular pressure of both eyes was within the normal range. Also, the relative afferent pupillary defect was negative.

Fundus examination of both eyes showed scattered dot and blot hemorrhages with some cotton-wool spots in the retina at mid-periphery, arterial narrowing, and reduced foveal reflex in the left macula (Fig. 1a). Spectral-domain optical coherence tomography (Heidelberg Engineering, Heidelberg, Germany) of the right eye showed normal retinal structures. The OCT of the left eye showed a large, dome-shaped cystic space with marginal septa, splitting the MZ and consistent with the BLD phenotype (Fig. 2).

Fluorescein angiography of both eyes showed multiple diffuse capillary non-perfusion areas in the peripheral retina. Also in the left eye, an area of fluorescein leakage due to large retinal neovascularization on the superior arcade was noted (Fig. 1b).

With the diagnosis of early proliferative diabetic retinopathy with BLD, the patient was scheduled for intravitreal injection of anti-VEGFs (bevacizumab 1.25 mg) and panretinal photocoagulation laser therapy. Two weeks after injection, central retinal thickness as well as BLD was significantly decreased. After 4 weeks, BCVA improved to 20/25 with complete resolution of BLD (Fig. 3).

Discussion

In essence, the bacillary layer is the retinal photoreceptor layer, containing both the inner and outer segments of the photoreceptor cells [6], and was named in the 1940s by Polyak [7]. The inner segment of photoreceptors contains myoid and ellipsoid parts on OCT images. Based on histopathologic studies, the ellipsoid is a highly dense layer of mitochondria; meanwhile, the myoid has endoplasmic reticula, ribosomes, and Golgi bodies despite a low number of mitochondria [8].

BLD is a newly defined OCT-based terminology proposed by Mehta et al. [1] for the first time. In this detachment, the “bacillary layer” (remaining myoids, ellipsoids, and outer segments) is attached to the retinal pigment epithelium (RPE), whereas the remaining fragments of split myoids, the ELM, as well as anterior retinal structures detach and move anteriorly. It has been hypothesized that two main factors are essential for BLD formation:

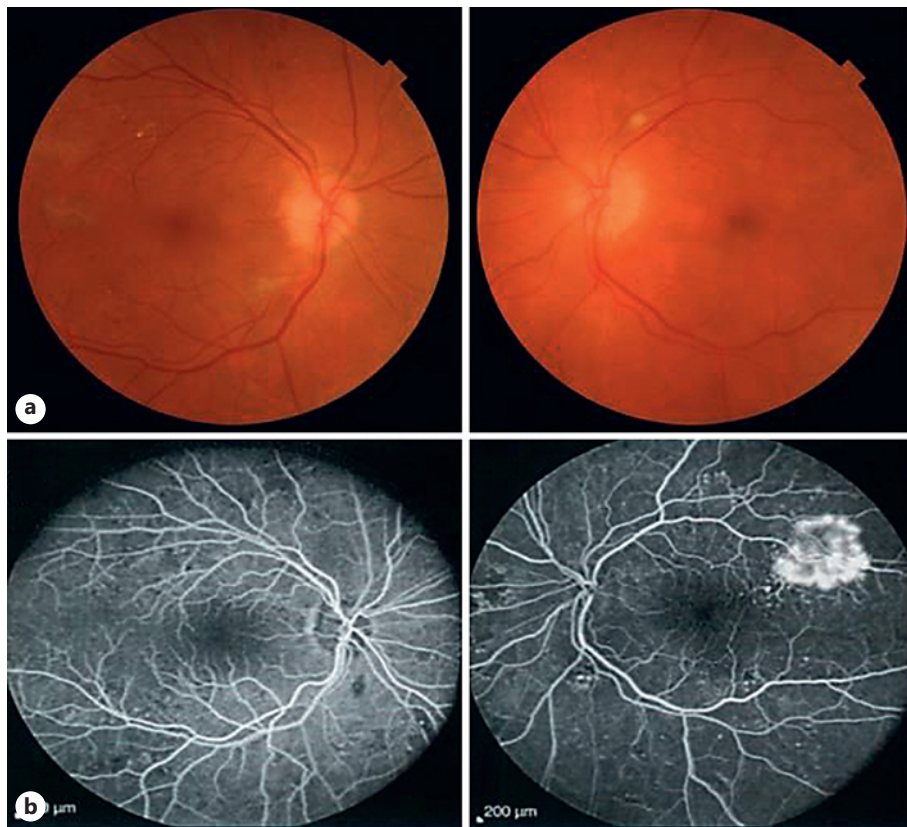


Fig. 1. **a** Fundus photography of both eyes showed scattered dot and blot hemorrhages with some cotton-wool spots in the retina. Arterial narrowing was obvious and normal foveal reflex was disrupted in the left macula. **b** Fluorescein angiography of both eyes showed multiple diffused capillary non-perfusion areas in the peripheral retina. Also in the left eye, an area of fluorescein leakage due to large retinal neovascularization was noted on the superior arcade.

1. The potential loose space within the photoreceptors
2. A hydrostatic force from the choroid strong enough to split the photoreceptors [1]

In previously reported cases of BLD, most have occurred in diseases that demonstrate a rapid accumulation of fluid such as Vogt-Koyanagi-Harada (VKH), ocular toxoplasmosis, eye blunt trauma with choroidal rupture, acute idiopathic maculopathy, acute posterior multifocal placoid pigment epitheliopathy, central serous chorioretinopathy, drug-related retinal toxicities, choroidal osteoma, choroidal metastasis, and type 2 macular neovascularization and subretinal hemorrhage [2–6, 9].

The mechanism of BLD remains to be determined. It has been hypothesized that inflammatory, infiltrative, or ischemic conditions of the choroid reduce the perfusion of the outer retinal layers and RPE, altering the balance of the retina and resulting in the splitting of EZ from MZ [6]. Kohli et al. [6] have speculated that the vertical septa in bacillary detachment arranged due to mitochondrial migration secondary to outer retinal hypoperfusion. So, resolving of BLD can be expected in the condition of circulation improvement after diminishing the underlying inflammation.

The MZ bounded by the ELM and EZ is the weakest part of photoreceptors [9]. Prithvi Ramtohol et al. [10] have hypothesized that like exudative retinal detachment, the destruction of the RPE component of the external retinal blood barrier may be essential for BLD. This

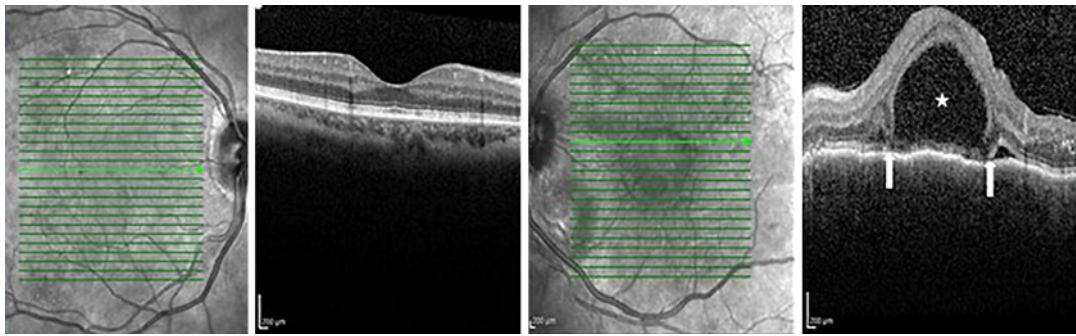


Fig. 2. Spectral-domain optical coherence tomography of both eyes. In the right eye, normal retinal structures were revealed, but in the left eye, dome-shaped cystic space (white star) containing marginal septa (arrows) which had split the MZ from EZ was detected. Choroidal congestion and RPE corrugation were also evident.

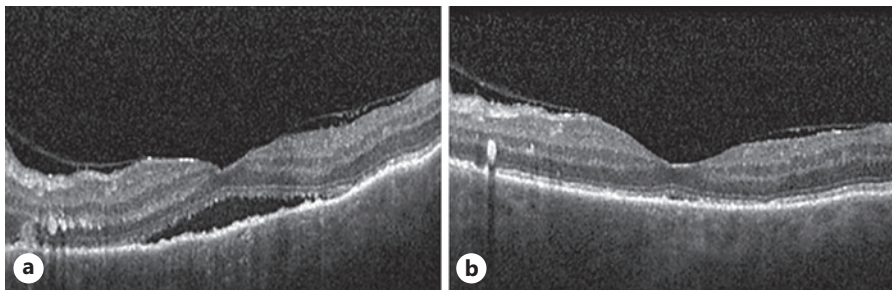


Fig. 3. Optical coherence tomography of the left eye. **a** Two weeks after intravitreal bevacizumab injection, central retinal thickness was significantly decreased. **b** 4 weeks after injection, complete resolution of bacillary detachment and RPE corrugation was occurred.

hypothesis is consistent with late-stage fluorescein angiograms showing dye leakage and accumulation [10]. This RPE damage may be due to choroidal congestion along with increased hydrostatic pressure in this layer or choroidal ischemia. On the other hand, underlying choroidal ischemia in patients with different vascular disorders like diabetes mellitus may lead to photoreceptor stress and subsequent splitting since they are fed by the choriocapillaris [6]. To the best of our knowledge, BLD in a patient with diabetic retinopathy has never before been described. We hypothesize that choroidal changes due to ischemia may result in a rapid and pathological influx of exudative proteinaceous fluid through a defect in the BrM/RPE complex into the potential space bounded anteriorly by the ELM. It seems that treatment with anti-VEGF stabilizes and prevents further leakage into the outer retina and allows fluid within the stretched BLD to be rapidly reabsorbed, leading to flattening of the ELM. We believe that complete resolution of the RPE alterations after intravitreal anti-VEGF injection could exclude other possible choroidal diseases as the underlying pathology of BLD in our case. Similar to our case, Jung et al. [9] showed that the BLD was a transient phenomenon and highly responsive to intravitreal injections of anti-VEGF agents in eyes with type 2 macular neovascularization in association with marked improvements in visual acuity.

Therefore, resolving of BLD can be expected in the condition of circulation improvement after diminishing the underlying pathology [6]. Long-term follow-up demonstrated progressive restoration of the EZ, followed by the interdigitation zone after flattening of the BLD. The sequential pattern of evolution of the floor of BLD (presumably containing split

photoreceptor myoid, ellipsoids, and outer segments) provided direct morphological evidence that injured photoreceptors may show some degree of spontaneous inner and outer segment regeneration. It is speculated that persistent proximity between the IS ellipsoids and the RPE, which may contribute to the relative preservation of the IS mitochondria oxygenation from the choroid during the acute phase, promotes the rapid recovery during the follow-up by allowing uninterrupted and continuous delivery of glucose and other metabolic intermediates to mitochondria of the EZ. As proposed by Ishihara et al. [11], the metabolic activity of the photoreceptor mitochondria and the ability to rapidly regenerate outer segments by producing new disk membranes may be responsible for the relatively quick visual recovery in eyes with BLD.

In conclusion, we reported BLD in a patient with diabetic retinopathy, which resolved rapidly after a single intravitreal injection of bevacizumab with subsequent visual improvement. This study adds to the growing literature, which describes BLD as a marker of fluid accumulation in relation to several macular diseases.

Acknowledgments

We are grateful to the colleagues of Farabi Eye Hospital's retinal imaging center for their assistance with the acquisition of the data used in this study.

Statement of Ethics

Written informed consent was obtained from the patient for publication of the details of their medical case and accompanying images. The research was conducted ethically in accordance with the Declaration of Helsinki. Ethical approval is not required for this study in accordance with local or national guidelines.

Conflict of Interest Statement

The authors declare that they have no competing interests.

Funding Sources

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

A.A.: data collection, manuscript writing, and editing. H.R.: manuscript editing and patient's data analysis and interpretation. K.C.: manuscript writing. M.J.: manuscript editing and literature search. A.B. and Z.M.: designing the figures and manuscript editing. F.G.: patient's clinical care, patient's data analysis and interpretation, manuscript review, and supervising the project. All authors read and approved the final manuscript.

Data Availability Statement

All data generated or analysed during this study are included in this article and its online supplementary material. Further enquiries can be directed to the corresponding author.

References

- 1 Mehta N, Chong J, Tsui E, Duncan JL, Curcio CA, Freund KB, et al. Presumed foveal bacillary layer detachment in A patient with toxoplasmosis chorioretinitis and pachychoroid disease. *Retin Cases Brief Rep*. 2018 Aug 23.
- 2 Markan A, Aggarwal K, Gupta V, Agarwal A. Bacillary layer detachment in tubercular choroidal granuloma: a new optical coherence tomography finding. *Indian J Ophthalmol*. 2020;68(9):1944–6.
- 3 Tekin K, Teke MY. Bacillary layer detachment: a novel optical coherence tomography finding as part of blunt eye trauma. *Clin Exp Optom*. 2019;102(3):343–4.
- 4 Fernández-Avellaneda P, Breazzano MP, Fragiotta S, Xu X, Zhang Q, Wang RK, et al. Bacillary layer detachment overlying reduced choriocapillaris flow in acute idiopathic maculopathy. *Retin Cases Brief Rep*. 2019;19.
- 5 Cicinelli MV, Giuffré C, Marchese A, Jampol LM, Introini U, Miserocchi E, et al. The bacillary detachment in posterior segment ocular diseases. *Ophthalmol Retina*. 2020;4(4):454–6.
- 6 Kohli GM, Bhatia P, Shenoy P, Sen A, Gupta A. Bacillary layer detachment in hyper-acute stage of acute posterior multifocal placoid pigment epitheliopathy: a case series. *Ocul Immunol Inflamm*. 2020:1–4.
- 7 Polyak SL. The retina: the anatomy and the histology of the retina in man, ape, and monkey. Including: University; 1941.
- 8 Spaide RF, Curcio CA. Anatomical correlates to the bands seen in the outer retina by optical coherence tomography: literature review and model. *Retina*. 2011;31(8):1609–19.
- 9 Jung JJ, Soh YQ, Yu DJG, Rofagha S, Lee SS, Freund KB, et al. Bacillary layer detachment due to macular neovascularization. *Retina*. 2021 Oct 1;41(10):2106–14.
- 10 Ramtohl P, Engelbert M, Malclès A, Gigon E, Miserocchi E, Modorati G, et al. Bacillary layer detachment: multimodal imaging and histologic evidence of a novel optical coherence tomography terminology. *Retina*. 2021;41(11):2193–207.
- 11 Ishihara K, Hangai M, Kita M, Yoshimura N. Acute Vogt-Koyanagi-Harada disease in enhanced spectral-domain optical coherence tomography. *Ophthalmology*. 2009 Sep;116(9):1799–807.