



# Papillomacular retinoschisis associated with glaucoma: Response to topical carbonic anhydrase inhibitor

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## ABSTRACT

**Purpose:** We report the clinical courses of two patients with papillomacular retinoschisis in eyes with advanced glaucomatous optic neuropathy.

**Observations:** In case 1, a 67-year-old woman was diagnosed with papillomacular retinoschisis and normal tension glaucoma in the left eye. Her medication was switched from topical latanoprost to brinzolamide, resulting in gradual improvement in the papillomacular retinoschisis thereafter. In case 2, a 76-year-old man was diagnosed with papillomacular retinoschisis, foveal detachment, and normal tension glaucoma in the left eye. His medication was switched from topical tafluprost/timolol to brinzolamide, resulting in gradual improvement in the papillomacular retinoschisis and foveal detachment thereafter.

**Conclusions and Importance:** Papillomacular retinoschisis may occur in eyes with advanced glaucomatous optic neuropathy. Topical brinzolamide therapy may lead to improvement of papillomacular retinoschisis.

## 1. Introduction

Papillomacular retinoschisis has been well described in eyes with congenital optic disk abnormalities such as optic disk pit.<sup>1,2</sup> Recent case reports have suggested that papillomacular retinoschisis also may occur in eyes with advanced glaucomatous optic neuropathy.<sup>3–9</sup> Although the exact mechanisms by which papillomacular retinoschisis develops remain unclear, elevation or fluctuation of intraocular pressure (IOP), structural defects in the optic nerve head, and vitreous traction are thought to contribute to the development of the disease. We report the clinical courses of two patients with papillomacular retinoschisis in eyes with advanced glaucomatous optic neuropathy. We found that the macular retinoschisis improved with topical brinzolamide therapy in these two patients.

## 2. Findings

### 2.1. Case 1

A 67-year-old woman was referred for treatment of macular retinoschisis in the left eye. She was diagnosed with bilateral normal tension glaucoma for which she received topical latanoprost. On presentation, the best-corrected visual acuity (BCVA) was 20/20 and the IOP was 13 mmHg in the left eye. Fundus examination and optical

coherence tomography (OCT) of the left eye showed papillomacular retinoschisis and glaucomatous optic neuropathy with corresponding visual field defects (Fig. 1). Her medication was switched from topical latanoprost to brinzolamide in the left eye. The macular retinoschisis in the left eye improved gradually after starting the topical brinzolamide (Fig. 1). Macular thickness analyses of the left eye demonstrated that macular retinoschisis started to show improvement 3 months after starting the treatment and resolved almost completely 24 months after starting the treatment (Fig. 1). At the last visit 24 months after starting topical brinzolamide, the BCVA was 20/17 and the IOP was 13 mmHg in the left eye. The central foveal thickness of the left eye decreased from 451  $\mu$ m at the initial visit to 252  $\mu$ m at the last visit.

### 2.2. Case 2

A 76-year-old man was referred for treatment of macular retinoschisis in the left eye. He was diagnosed with bilateral normal tension glaucoma for which he received topical tafluprost/timolol. On presentation, the BCVA was 20/40 and the IOP was 11 mmHg in the left eye. Fundus examination and OCT of the left eye showed papillomacular retinoschisis, foveal detachment, and glaucomatous optic neuropathy with corresponding visual field defects (Fig. 2). His medication was switched from topical tafluprost/timolol to brinzolamide in the left eye. The macular retinoschisis and foveal detachment in the left eye

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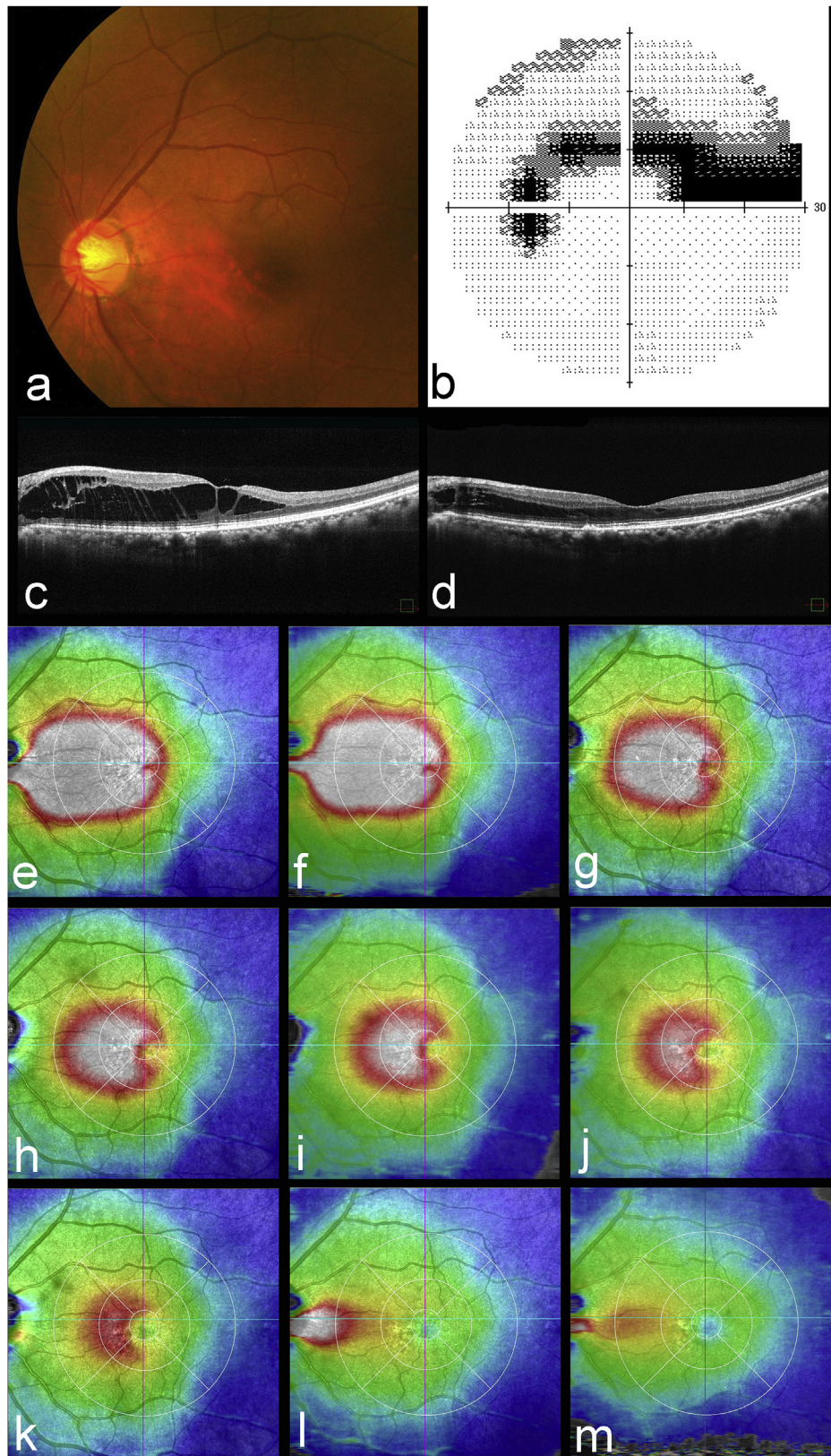
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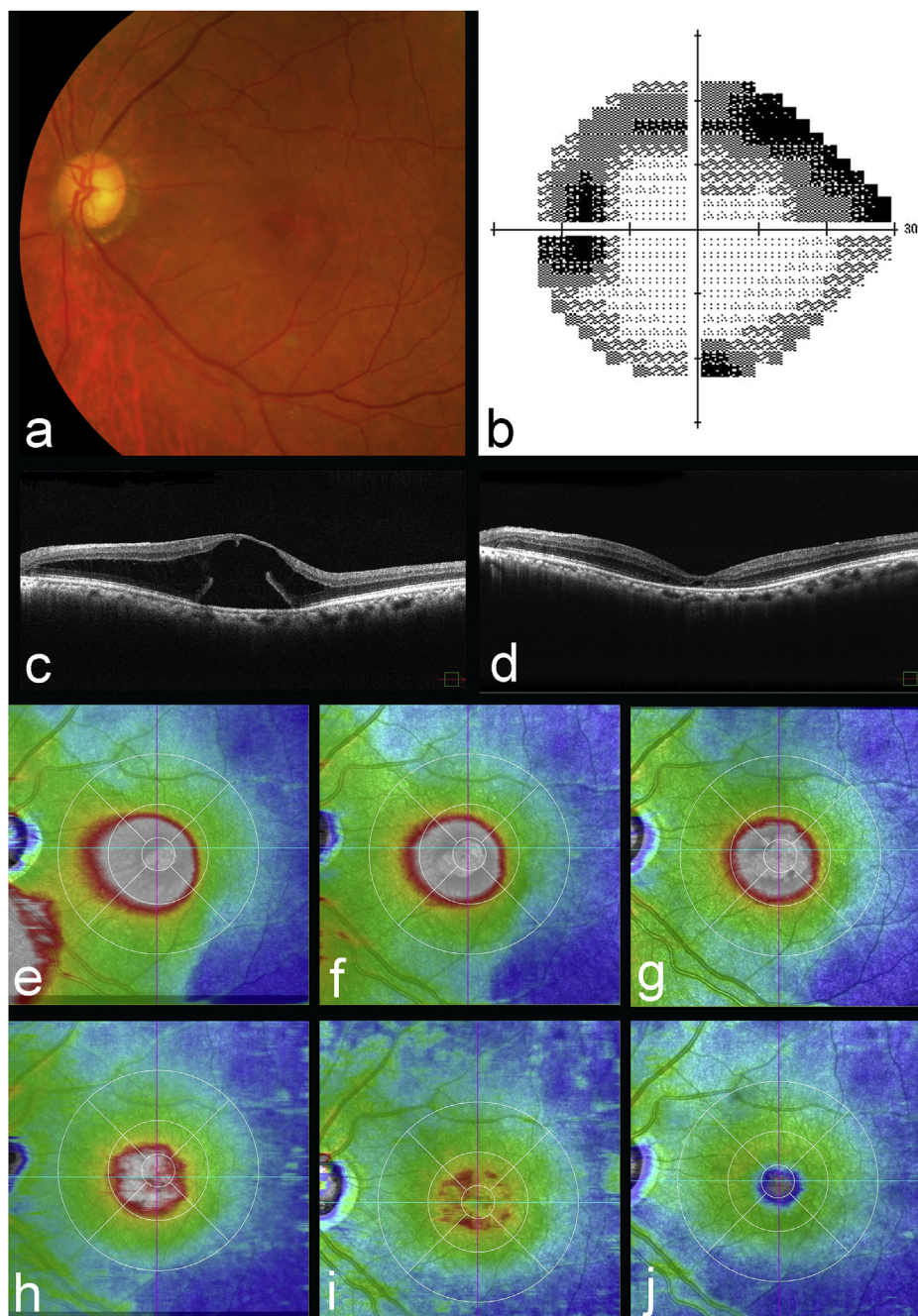
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**Fig. 1.** Case 1. A fundus photograph (a) and Humphrey 30-2 visual field (b) of the left eye at the initial visit. Horizontal spectral-domain optical coherence tomography images through the macula of the left eye at the initial visit (c) and 24 months after starting topical brinzolamide (d). Macular thickness analyses of the left eye at the initial visit (e) and at 1 month (f), 3 months (g), 4 months (h), 6 months (i), 7 months (j), 9 months (k), 15 months (l), and 24 months (m) after starting topical brinzolamide.



**Fig. 2.** Case 2. A fundus photograph (a) and Humphrey 24-2 visual field (b) of the left eye at the initial visit. Horizontal spectral-domain optical coherence tomography images through the macula of the left eye at the initial visit (c) and 18 months after starting topical brinzolamide (d). Macular thickness analyses of the left eye at the initial visit (e) and at 3 month (f), 6 months (g), 13 months (h), 15 months (i), and 18 months (j) after starting topical brinzolamide.

improved gradually after starting the topical brinzolamide (Fig. 2). Macular thickness analyses of the left eye demonstrated that macular retinoschisis and foveal detachment started to show improvement 3 months after starting the treatment and resolved almost completely 18 months after starting the treatment (Fig. 2). At the last visit 18 months after starting topical brinzolamide, the BCVA was 20/67 and the IOP was 15 mmHg in the left eye. The central foveal thickness of the left eye decreased from 786  $\mu\text{m}$  at the initial visit to 186  $\mu\text{m}$  at the last visit.

### 3. Discussion

We present two cases of papillomacular retinoschisis that seemed to be associated with advanced glaucomatous optic neuropathy. Neither

patient had signs of an optic disk pit, high myopia, vitreomacular traction, or X-linked retinoschisis that could have caused the macular retinoschisis. Peripapillary retinoschisis can develop in eyes with glaucoma, but it rarely extends to the macula. Lee et al. reported peripapillary retinoschisis in 22 (5.9%) of the 372 patients with glaucoma and in one (0.5%) of the 187 healthy controls; however, no patients developed macular retinoschisis.<sup>10</sup> Dhingra et al. reported 10 eyes that had peripapillary retinoschisis among eyes with open-angle glaucoma; however, only one eye had macular involvement.<sup>7</sup>

Topical carbonic anhydrase inhibitors effectively improve the macular retinoschisis in some cases of X-linked retinoschisis.<sup>11</sup> The clinical effects of topical carbonic anhydrase inhibitors are presumed attributable to their ability to enhance fluid transport across the retinal

pigment epithelium and to increase retinal adhesiveness. In the current two cases, the patients were switched to topical brinzolamide, and the papillomacular retinoschisis improved gradually, but not completely during the follow-up period. Considering potential requirement for long-term treatment, the utility of oral acetazolamide may be limited by potential systemic side effects, and a topical medication would be preferable. We could not completely exclude the possibility that the papillomacular retinoschisis resolved spontaneously<sup>5</sup>; however, no signs of posterior vitreous detachment were seen in the affected eyes during the follow-up period.

A few case reports have suggested that IOP reduction or improvement in IOP fluctuations may lead to resolution of macular retinoschisis in eyes with advanced glaucomatous optic neuropathy. Zumbro et al. reported a case of open-angle glaucoma in which macular retinoschisis resolved after filtering surgery that lowered the IOP from a range of 30–50 mmHg to 20–24 mmHg.<sup>3</sup> Woo et al. reported a case of open-angle glaucoma in which the macular retinoschisis resolved after trabeculectomy that lowered the IOP and improved posture-related IOP fluctuations.<sup>6</sup> However, sustained topical brinzolamide therapy itself seemed to have positively affected the papillomacular retinoschisis in the current two cases, because the switch in medications did not lower the IOPs.

A few case series have indicated that pars plana vitrectomy may be effective for the treatment of macular retinoschisis in eyes with advanced glaucomatous optic neuropathy. Inoue et al. reported that macular retinoschisis associated with advanced glaucomatous optic neuropathy resolved or reduced in all of their 11 cases after pars plana vitrectomy; however, macular holes occurred postoperatively in 4 of the eyes. Yoshikawa et al. reported that macular retinoschisis associated with advanced glaucomatous optic neuropathy reduced in all of their 5 cases after pars plana vitrectomy; however, macular holes occurred postoperatively in 2 of the eyes. Given the high rate of macular hole formation among patients treated with pars plana vitrectomy, we believe that topical brinzolamide therapy may be worth trying first for the treatment of papillomacular retinoschisis in eyes with advanced glaucomatous optic neuropathy.

#### 4. Conclusions

Papillomacular retinoschisis may develop in eyes with advanced glaucomatous optic neuropathy. The current two cases suggest that topical brinzolamide therapy may lead to improvement of papillomacular retinoschisis. However, more cases and observation are needed to determine the optimal treatment for papillomacular retinoschisis in eyes with advanced glaucomatous optic neuropathy.

#### Patient consent

Consent to publish the case series was not obtained. This report does not contain any personal information that could lead to the identification of the patients. The Ethical Committee of Kurume University

approved this study and waived the need for individual patient consent.

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#### Authorship

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

#### CRedit authorship contribution statement

**Masatoshi Haruta:** Conceptualization, Writing - original draft, Supervision. **So Handa:** Resources. **Shigeo Yoshida:** Project administration.

#### Declaration of competing interest

The following authors have no financial disclosures: MH, SH, SY.

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