

## Title page

**Title:** Cystoid macular edema in polypoidal choroidal vasculopathy viewed by a scanning laser ophthalmoscope

**Subtitle:** CME in PCV viewed by SLO

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### Key words/Abstract/Abbreviations

**Key words:** cystoid macular edema, optical coherence tomography, polypoidal

choroidal vasculopathy, scanning laser ophthalmoscope.

5 **Abstract:** Visual prognosis for polypoidal choroidal vasculopathy (PCV) is reported  
to be relatively good. However, some eyes in the end-stage of PCV show cystoid  
macular edema (CME) with severe loss of vision. We examined two eyes with CME  
in the end-stage of PCV. The fundus of each of these eyes was examined  
non-invasively with a new commercially available scanning laser ophthalmoscope  
10 (SLO) in the retro-mode with an infrared laser. In the retro-mode, scattered light that  
passed the aperture deviated laterally, giving a shadow to the silhouetted cystoid  
spaces, enabled visualisation of the CME. In each eye, although no cystoid spaces  
were detected on fundus photographs, monochromatic images obtained with an SLO  
in the retro-mode showed numerous cystoid spaces on the disciform scar. SLO in  
15 the retro-mode can show each cystoid space located in any layer of the retina, and  
allows us to detect the extent of the CME.

## Introduction

Visual prognosis of polypoidal choroidal vasculopathy (PCV) is reported to be relatively good, compared with that of age-related macular degeneration [1]. Small lesions of PCV sometimes regress without any treatment, resulting in good visual recovery. In addition, a number of reports have shown the potential effectiveness of photodynamic therapy on reduction of the exudative change associated with PCV [2].

While a disciform scar is reported to be a rare feature of PCV, some eyes in the end-stage of PCV show cystoid macular edema (CME), with severe loss of vision. Herein, we report two cases of CME in eyes with end-stage PCV that were documented non-invasively with a new commercially available scanning laser ophthalmoscope (SLO) in the retro-mode.

## Case reports

For this report, we retrospectively reviewed the medical records of 2 patients (2 eyes) with end-stage PCV; both patients had severe visual disturbance due to CME. The diagnosis of PCV was based on indocyanine green angiography, which showed a branching vascular network that terminated in polypoidal lesions. In both eyes, CME was examined non-invasively with a newly available SLO (F-10, Nidek, Gamagori, Japan), in which the fundus was scanned with an infrared laser (wave-length, 790 nm) in the retro-mode.

**CASE 1.** A 75-year-old woman, diagnosed as having subfoveal PCV in the right eye, was treated with photodynamic therapy 2 years ago (Fig. 1). Although the eye showed persistent exudative change and she continued to have decreased visual acuity (0.05 OD), she refused additional treatment. A fundus photograph showed a subfoveal disciform scar with extensive subretinal hemorrhage, but no cystoid spaces were detected. Monochromatic images obtained with an SLO in the retro-mode, however, showed numerous cystoid spaces on the disciform scar.

**CASE 2.** A 71-year-old man diagnosed with PCV was treated 3 times with photodynamic therapy in the right eye (Fig. 2). Unfortunately, the eye showed a recurrence of the exudative change with decreased visual acuity (0.4 OD), and, accordingly, the eye was treated with a fourth administration of photodynamic therapy, combined this time with an intravitreal injection of triamcinolone acetonide. Six months after this treatment, the fundus photograph revealed a disciform scar, but no cystoid spaces were seen. An image obtained with an SLO in the retro-mode showed numerous cystoid spaces, with a large cystoid space accompanying many extrafoveal cystoid spaces. Optical coherence tomography (OCT; 3DOCT-1000, Topcon, Tokyo, Japan) showed a large foveal cystoid space and numerous small cystoid spaces in the inner and outer nuclear layers. Visual acuity at this time was

0.15 in the right eye.

## Discussion

To date, few methods are available to examine the extent of CME and to photograph  
5 the CME. Although fluorescein angiography often shows each cystoid space as a  
pooling of dye, it is an invasive examination. It was reported previously that SLO in  
the dark-field mode with an infrared laser could non-invasively show each cystoid  
space [3, 4]. In the dark-field mode, an aperture with a central stop is used, and  
scattered light from the deeper layer silhouettes each cystoid space [4]. The images  
10 obtained in this dark-field mode, however, have low contrast, and are inferior to those  
obtained by fluorescein angiography [3]. In the current study, CME was examined  
non-invasively using SLO in the newly-developed retro-mode with an infrared laser.  
The retro-mode uses an aperture with a modified central stop, and the aperture is  
deviated laterally from the confocal light path. The scattered light that passes this  
15 deviated aperture thus gives a shadow to the silhouetted cystoid spaces, which allows  
for clear visualisation of CME, even its depth.

OCT is useful to examine CME in cross-section images, and allows us to  
measure quantitatively the thickness of the CME. With cross sections, however, it is  
not easy to detect the extent of the cystoid spaces. En face sections can be taken  
20 with some spectral-domain OCTs [5]. However, because the sectional plane in OCT

is thin, it doesn't show those cystoid spaces that are outside of the sectional plane.

In contrast, because the scattered light passes through a relatively large aperture in the retro-mode, it shows all cystoid spaces—regardless of the layer of retina in which they occur. SLO in the retro-mode should thus be extremely helpful in determining

5 the extent of CME.

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## Figure legends

**Fig. 1** A 75-year-old woman was diagnosed as having subfoveal polypoidal choroidal vasculopathy in the right eye, for which she was treated with photodynamic therapy 2 years ago. Unfortunately, the eye showed persistent exudative change with decreased visual acuity (0.05 OD), and she refused additional treatments. (a) A fundus photograph showed a disciform scar with extensive subretinal hemorrhage; no cystoid spaces were seen. (b) Indocyanine green angiography showed polypoidal lesions (arrows). (c) A monochromatic image obtained using a scanning laser ophthalmoscope in the retro-mode with an infrared laser showed, non-invasively, numerous cystoid spaces on the disciform scar. The box in Figure 1a delimits the scanned area. (d) Fluorescein angiography showed each cystoid space as a pooling of the dye. (e, f) Magnified images of Figures 1c and 1d showed that each cystoid space seen in the retro-mode (e) was consistent with that seen as pooling of the dye (f). (g, h) Horizontal (g) and vertical (h) sections taken with optical coherence tomography showed cystoid spaces on the disciform scar.

**Fig. 2** A 71-year-old man was diagnosed as having polypoidal choroidal vasculopathy in the right eye. Although he was treated 3 times with photodynamic therapy, the eye showed a recurrence of the exudative change with decreased visual



acuity (0.4 OD). (a) A fundus photograph showed recurrent reddish-orange nodules (arrow). (b) Indocyanine green angiography showed polypoidal lesions consistent with the reddish-orange nodules seen on fundus photography (arrow). (c) Fluorescein angiography showed classic choroidal neovascularisation. His right eye was treated with the fourth photodynamic therapy combined with an intravitreal injection of triamcinolone acetonide. (d) Six months after treatment, the fundus photograph showed a disciform scar. Visual acuity in the right eye was 0.15, and no cystoid spaces were seen on the fundus photograph. (e) Numerous cystoid spaces were detected in an image obtained using a scanning laser ophthalmoscope in the retro-mode with an infrared laser. A large foveal cystoid space accompanied many small spaces. (f, g) Optical coherence tomography horizontal (f) and vertical (g) sections centered on the fovea showed the large foveal cystoid space and small spaces in the inner and outer nuclear layers.

Figure 1  
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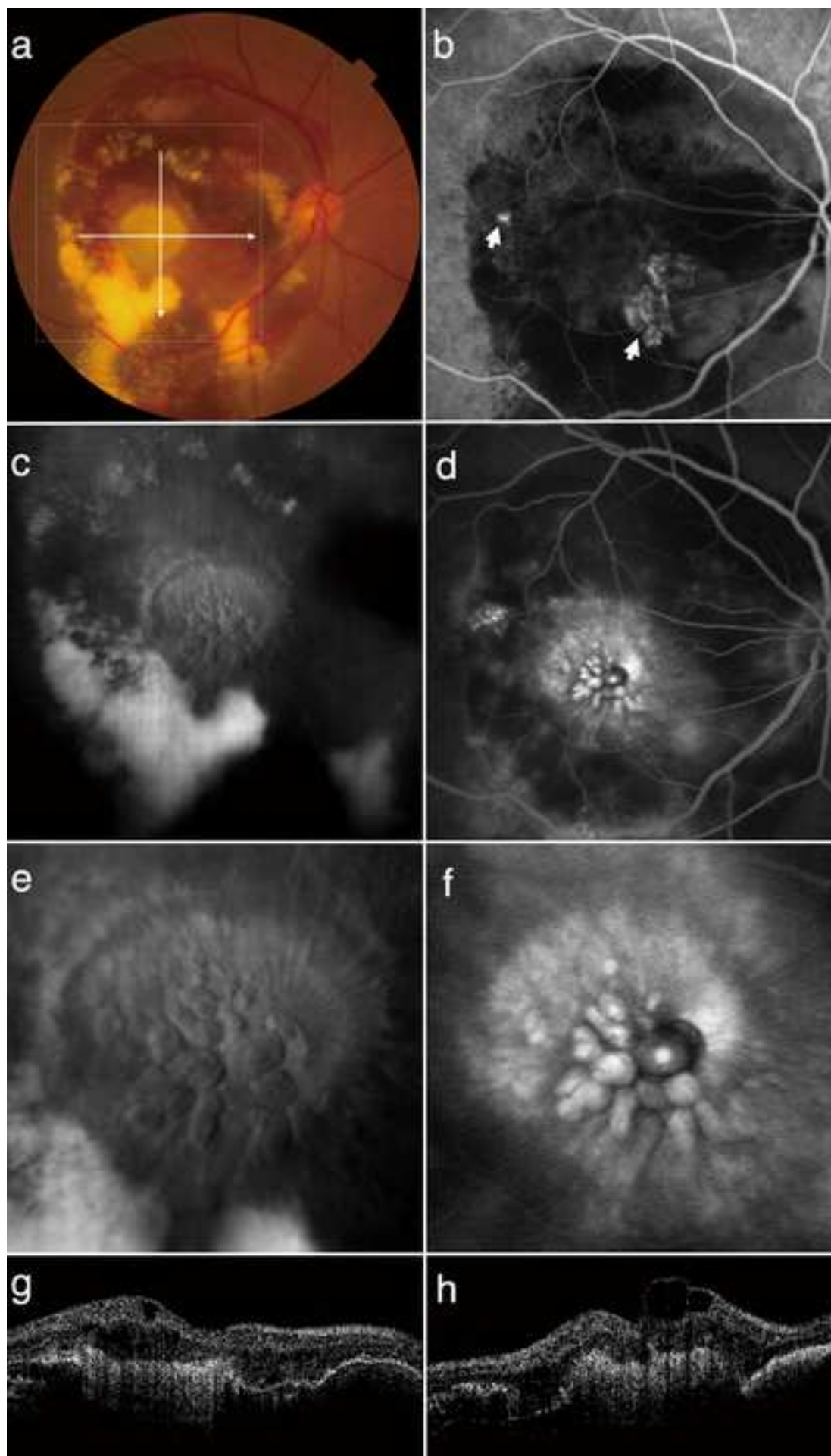


Figure 2  
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