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Fundus Autofluorescence and Spectral-domain Optical Coherence Tomography Findings of Leopard Spots in Nanophthalmic Uveal Effusion Syndrome

Authors: Tetsuhiko Okuda, M.D., Ph.D., Tomomi Higashide, M.D., Ph.D., Yuka Wakabayashi, M.D., Akira Nishimura, M.D., Ph.D., Kazuhisa Sugiyama, M.D., Ph.D.

Affiliations:
Department of Ophthalmology, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan.

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Correspondence: Tetsuhiko Okuda, M.D.
Department of Ophthalmology, Kanazawa University Graduate School of Medical Science, 13-1 Takara-machi, Kanazawa, Ishikawa Prefecture 920-8641, Japan.
Telephone: +81-76-265-2403; FAX: +81-76-222-9660
Email address: okuda@med.kanazawa-u.ac.jp

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Optical coherence tomography

Retinal pigment epithelium

Abstract

Purpose. To describe fundus autofluorescence (FAF) imaging and spectral domain optical coherence tomography (SD-OCT) findings of leopard spots in nanophthalmic uveal effusion syndrome.

Methods. A 34-year-old man with retinal detachment associated with nanophthalmic uveal effusion syndrome in the right eye underwent sclerostomy three times. After the final surgery, the subretinal fluid resolved gradually. Then, SD-OCT examination, FAF photography, fluorescein angiography (FA) and indocyanine green angiography (ICGA) were performed simultaneously with the Spectralis Heidelberg Retina Angiograph+OCT system.

Results. SD-OCT revealed focal thickening of the retinal pigment epithelium (RPE) layer at the same locations as leopard spots, which appeared hypofluorescent on FA and ICGA. These spots showed hyperautofluorescence on FAF imaging. Six months later, focal thickening of the RPE layer became smaller on OCT and hyperautofluorescence was attenuated on FAF imaging.

Conclusions. Simultaneous imaging of the fundus with multiple modalities including OCT, FAF, FA and ICGA indicates that leopard spots in the fundus of uveal effusion syndrome may show hyperautofluorescence and correspond to focal thickening of the RPE layer by SD-OCT. This imaging method may help elucidate the pathology of various fundus lesions *in vivo*.

Introduction

Nanophthalmos is a rare condition usually involving a very short axial length, a thickened sclera and hyperopia, which may cause uveal effusion syndrome. Brockhurst [1] and Gass [3] hypothesized that a scleral abnormality causes exudative choroidal retinal detachments in this syndrome.

In uveal effusion syndrome, angiographic findings, such as leopard-spot pattern changes on fluorescence angiography (FA) [3, 4, 8] or diffuse hyperfluorescence in the choroid on indocyanine green angiography (ICGA) [8], were reported. Forrester et al [2] reported proliferation and migration of retinal pigment epithelium (RPE) cells in the subretinal space of uveal effusion syndrome by histology and they hypothesized that leopard-spot changes corresponded to the foci of RPE proliferations and multi-layering.

Fundus autofluorescence (FAF) examination is a non-invasive method for evaluating the health of the RPE. Usefulness of FAF was reported in various retinal diseases including Stargardt's disease and Best's disease. [5-7] In this report, we examined fundus leopard spots in a case with uveal effusion syndrome by simultaneous imaging by FA, ICGA, FAF and spectral domain optical coherence tomography (SD-OCT). The procedure enabled us to identify the exact characteristics of leopard spots in SD-OCT and FAF imaging.

Case report

A 34-year-old man presented with sudden blurred vision in his right eye. He had been diagnosed with nanophthalmos at 10 years of age in our institution and his best corrected visual acuity was 20/40 in each eye. Visual acuity was 20/66 in the right eye and 20/40 in the left eye, wearing +20.0 diopters bilaterally. Slit lamp examination disclosed a shallow anterior chamber, dilated episcleral vessels and detached retina behind the lens in the right eye. Fundus examination demonstrated almost total exudative retinal detachment in his right eye and bilateral retinal vascular dilation and tortuosity (Fig. 1A). B-scan ultrasonography showed a short axial length and a thickened sclera in both eyes. The axial length was 15.9 mm in the left eye. No hyperfluorescence or inflammatory findings appeared on FA in either eye. On the basis of these clinical findings, we diagnosed him with nanophthalmic uveal effusion syndrome.

We performed sclerectomy three times. The first and second surgeries resulted in recurrence of uveal effusion at three and four weeks postoperatively, respectively. After the final surgery, the subretinal fluid resolved gradually and scattered pigmentary spots appeared at 2 months postoperatively (Fig. 1B). FA, ICGA, FAF imaging and SD-OCT examination were performed with the Spectralis Heidelberg Retina Angiograph (HRA)+OCT system (Heidelberg Engineering, Heidelberg, Germany). For FAF or angiographic examination, SD-OCT images with frame averaging under eye tracking were acquired simultaneously. FA showed a number of hypofluorescent spots (Fig. 1C), which appeared hypofluorescent in ICGA (Fig. 1D). ICGA also demonstrated diffuse hyperfluorescence in the choroid (Fig. 1D). These spots were hyperautofluorescent on FAF imaging (Fig. 1E). Furthermore, simultaneous

SD-OCT revealed that focal thickening of the RPE layer (Fig. 1F) corresponded to the hypofluorescent spots on FA and ICGA and the hyperfluorescent spots on FAF imaging (Fig. 1C, D, E). Eight months after the final surgery, the leopard-spot patterns faded in the fundus photograph and by FA and ICGA (Fig. 2A, B, C). However, diffuse hyperfluorescence remained unchanged by ICGA (Fig. 2C). Hyperautofluorescence was attenuated on FAF imaging (Fig. 2D) and focal thickening of the RPE layer became smaller on OCT (Fig. 2E).

Retinal detachment did not recur for 10 months after the final surgery. Corrected vision improved to 20/40 and the axial length was 15.8 mm in the right eye.

Discussion

This case report showed that leopard spots in the fundus of uveal effusion syndrome, which appeared hypofluorescent on FA and ICGA, may show hyperautofluorescence and correspond to focal thickening of the RPE layer by SD-OCT. A Pubmed search could not find any previous reports on autofluorescence and OCT findings of leopard spots. Forrester et al [2] reported the presence of proliferation and migration of RPE cells in the subretinal space of uveal effusion syndrome by histology and speculated that the leopard-spot-like pigmentary fundus changes could correspond to foci of RPE proliferation and multi-layering. Our study using SD-OCT corroborated their hypothesis *in vivo*.

FAF examination is a non-invasive method for evaluating the health of the RPE. The degree of FAF depends on the distribution of lipofuscin in the RPE. Lipofuscin accumulates in RPE cells as a byproduct of phagocytosis of the photoreceptors. Hyperautofluorescence on FAF imaging can be observed in various diseases including age-related macular degeneration, Stargardt's disease, adult vitelliform macular dystrophy, Best's disease, central serous chorioretinopathy, pseudoxantoma elasticum, and retinal detachment. [5-7] Spaide et al [7] reported that hyperautofluorescence was observed where subretinal fluid persisted after the scleral buckling procedure. In their case, however, OCT showed an accumulation of outer retinal material but did not show focal thickening of the RPE layer, which was observed in this case of uveal effusion syndrome. Schmitz et al [5] described that FAF increased with migration of RPE cells or macrophages, which contain lipofuscin. Given that leopard spots in the fundus appeared as scattered hyperfluorescent spots on FAF imaging, lipofuscin accumulation in RPE cells may have increased by enhanced phagocytosis of the photoreceptors by proliferative RPE cells in the regions that correspond to focal thickening of the RPE layer by SD-OCT. Combining the findings of SD-OCT and FAF imaging, focal hyperactivity of the RPE may have occurred along with resolution of retinal detachment in uveal effusion syndrome, which appeared as leopard spots. Six months later, hyperautofluorescence was attenuated and the corresponding focal thickening of the RPE layer became smaller in SD-OCT. Also, leopard-spot pattern changes became less remarkable in fundus photographs and on FA. These changes over time may indicate a repair process of RPE. However, diffuse hyperfluorescence remained unchanged on ICGA (Fig.

4D) at 8 months after the final surgery indicating sustained abnormalities in the choroidal circulation. This finding agrees with Uyama's report that marked hyperfluorescence on ICGA was observed one year after surgery in uveal effusion syndrome.[8]

In conclusion, Simultaneous imaging of the fundus with multiple modalities including OCT, FAF, FA and ICGA indicates that leopard spots in the fundus of uveal effusion syndrome may show hyperautofluorescence and correspond to focal thickening of the RPE layer in SD-OCT. This imaging method may help elucidate the pathology of various fundus lesions *in vivo*.

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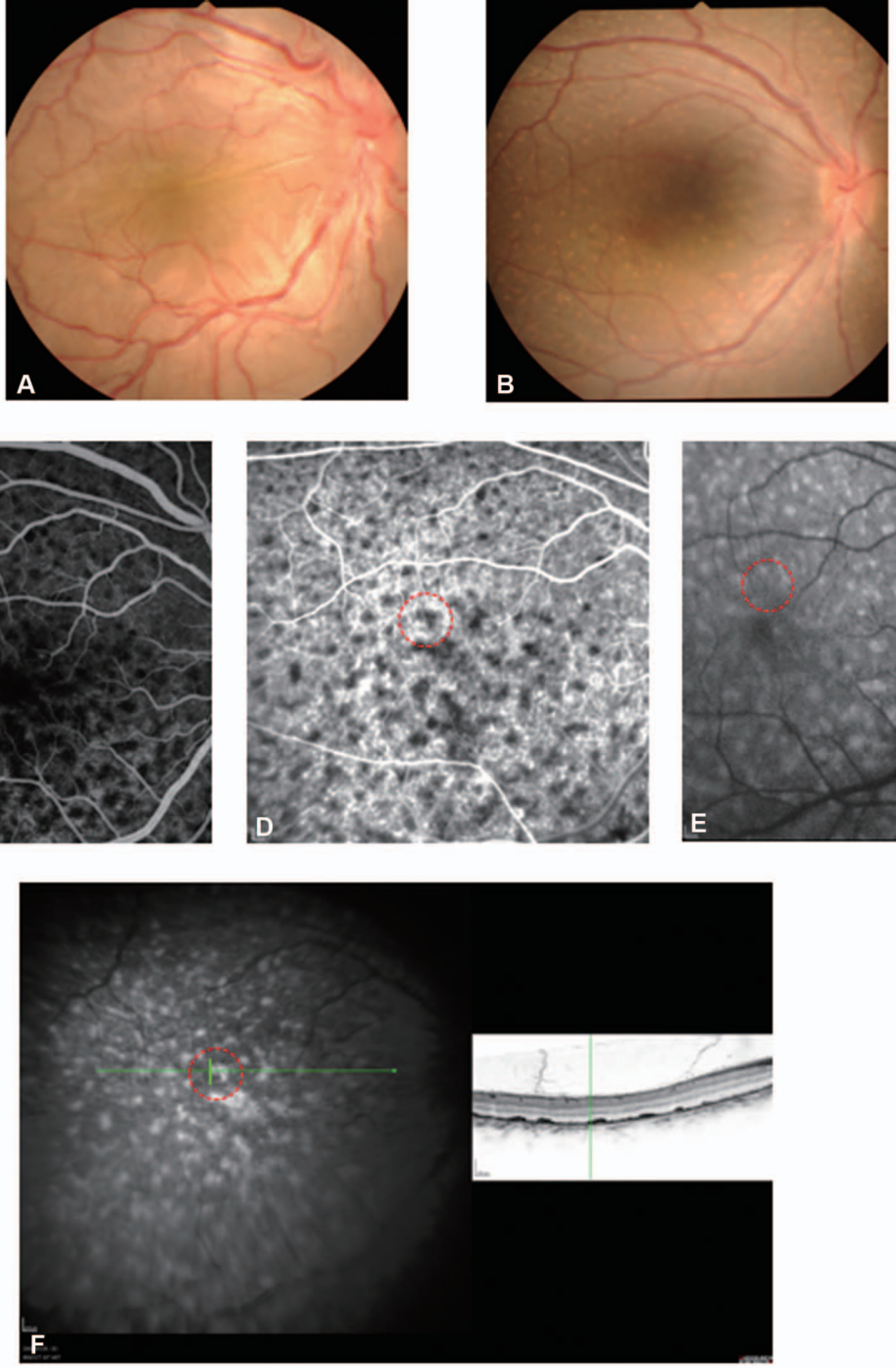
LEGENDS

Figure 1. Preoperative fundus photography (A) revealed almost total exudative retinal detachment and bilateral retinal vascular dilation and tortuosity. Fundus photographic (B), FA (C), ICGA (D), FAF (E) and SD-OCT (F) images at 2 months after the final surgery. Red circles (C, D, E and F) indicate the same location in the fundus. Green lines indicate the scan positions on SD-OCT image (F). Scattered pigmentary spots appeared in the fundus photograph (B). FA showed the leopard-spot pattern of hypofluorescence (C) and ICGA demonstrated hypofluorescent spots on a background of diffuse hyperfluorescence of the choroid (D). Scattered hyperfluorescent spots were observed on FAF imaging (E). SD-OCT revealed multiple focal thickening of the RPE layer. (F). Comparing the images in red circles, the RPE lesion appeared hypofluorescent on FA (C) and ICGA (D), and hyperfluorescent on FAF imaging (E).

Figure 2. Fundus photographic (A), FA (B), ICGA (C), FAF (D) and SD-OCT (E) images at 8 months after the final surgery. A red circle (E) indicates the same location in the fundus as those in Fig. 1 and green lines indicate the scan positions on SD-OCT image (E). Leopard-spot pattern changes faded in the fundus photograph and on FA and ICGA (A, B, C). Hyperautofluorescence was attenuated on FAF imaging (D). However, diffuse hyperfluorescence remained unchanged on ICGA (C). Comparing the images in red circle in Fig. 1, focal thickening of the RPE layer became smaller on OCT images at 8 months postoperatively (E).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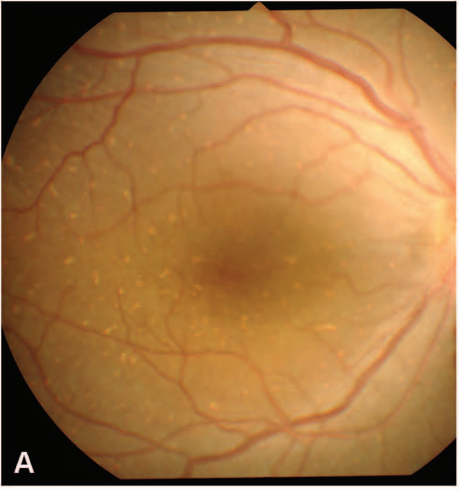
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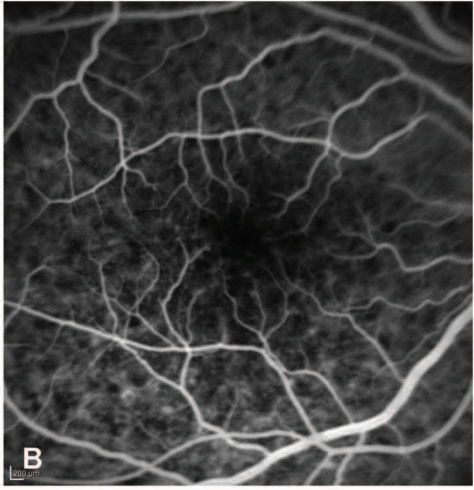
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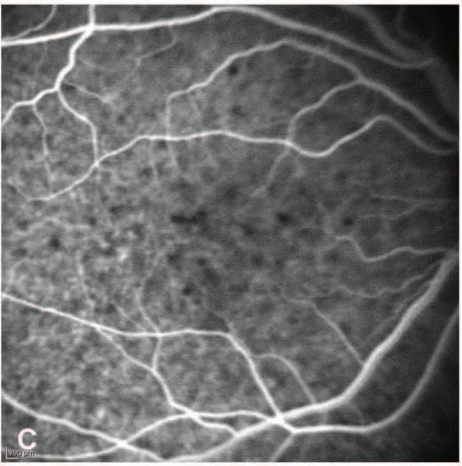
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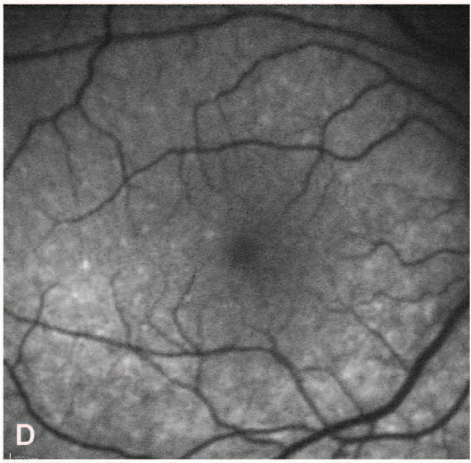
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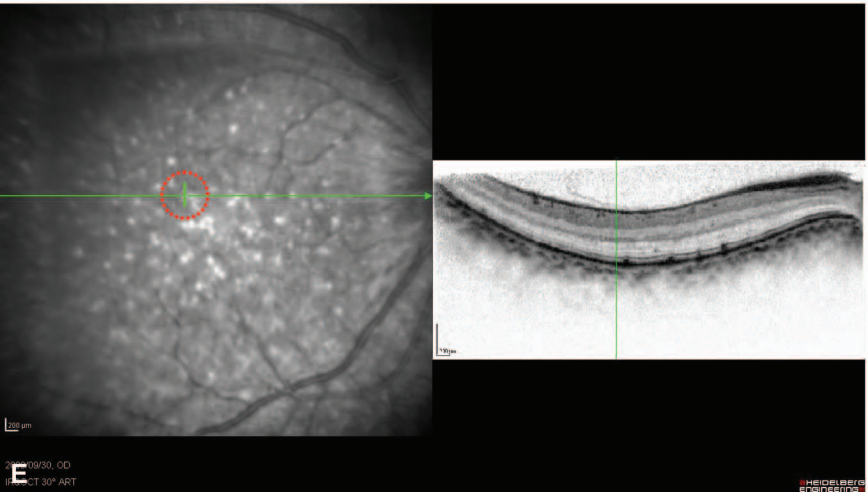
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