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OPHTHALMOLOGY (2002) 109(11):2165–2169.

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Ishiko, S; Akiba, J; Horikawa, Y; Yoshida, A

Detection of Drusen in the Fellow Eye of Japanese Patients with Age-Related Macular Degeneration Using Scanning Laser Ophthalmoscopy

Satoshi Ishiko,^{1,2} Jun Akiba,¹ Yoshitaka Horikawa,^{1,2} Akitoshi Yoshida¹

¹Department of Ophthalmology, Asahikawa Medical College, Asahikawa, Japan. ²Schepens Eye Research Institute, Department of Ophthalmology, Harvard Medical School, Boston, MA.

Presented in part at the Annual Meeting of the Association for Research in Vision and Ophthalmology (ARVO), May 1, 2000, Fort Lauderdale, Florida

Running head: Detection of drusen in the fellow eye of Japanese patients with AMD

Correspondence and reprint requests to Satoshi Ishiko, MD, PhD, Department of Ophthalmology, Asahikawa Medical College, 2-1 Midorigaoka Higashi, Asahikawa, 078-8510 JAPAN (phone: 81-166-68-2543; fax: 81-166-68-2549; e-mail, ishiko@asahikawa-med.ac.jp).

The authors have no proprietary interest in any aspect of this report.

Précis

Compared with photography, scanning laser ophthalmoscopy can detect drusen more precisely and demonstrate a higher prevalence of drusen in the fellow eye of Japanese patients with AMD.

Abstract

Objective: To study the prevalence of drusen in the fellow eye of Japanese patients with age-related macular degeneration (AMD).

Design: Retrospective, cross-sectional study.

Participants: Seventeen eyes of 17 Japanese patients with unilateral AMD.

Main Outcome Measures: To compare the frequency of drusen based on photography and scanning laser ophthalmoscopy with confocal and ring apertures and a diode laser (780 nm).

Results: Using the scanning laser ophthalmoscope (SLO) with a ring aperture, drusen were clearly detected as in topographic imaging. In the fellow eyes of the study patients with AMD, photography showed drusen in 10 cases (58.8%), however, SLO imaging detected drusen in 15 cases (88.2%). The number of drusen detected using SLO imaging was significantly greater than when using photography ($P<0.05$).

Conclusions: SLO imaging is superior to photography for detecting drusen in the fellow eyes of Japanese patients with unilateral AMD. The prevalence of drusen in the fellow eye of Japanese patients with AMD is much higher than previously speculated.

Age-related macular degeneration (AMD) is an important cause of severe visual impairment.¹⁻⁵ Drusen has been reported to be one of the important early changes associated with AMD. Recently, the prevalence of AMD has increased in Japanese patients, and therefore, detecting the early AMD changes is important for patient follow-up. However, because drusen have not always been detected in Japanese patients, even though they were diagnosed clinically with AMD, this form of AMD without drusen has been referred to as Japanese AMD. An interesting question, however, is raised because of this: Is the occurrence of drusen actually low in Japanese patients, or are drusen barely detectable in this non-white population with richly pigmented retinal pigment epithelium (RPE)?

A detailed fundus image from the retinal surface to the choroids through the RPE can be easily obtained using a scanning laser ophthalmoscope (SLO, Rodenstock, Düsseldorf, Germany). The SLO infrared indirect imaging has been reported to allow exceptionally easy visualization of drusen.⁶⁻⁹

This study was performed to determine the frequency with which drusen occur based on photographic documentation and using the SLO to examine the fellow eyes of Japanese patients with unilateral AMD.

Patients and methods

Seventeen consecutive Japanese patients over 50 years of age (mean age, \pm SD, 67.1 \pm 7.5) who were diagnosed with unilateral AMD based on the findings of a fundus examination and fluorescein angiography and who also underwent an SLO examination between July 1999 to December 1999, were selected by retrospective clinical chart review for inclusion in this study. The frequency of drusen based on photography and on SLO imaging in the fellow eye of the eye with unilateral AMD was studied. Different examiners performed these examinations on the same day. The evaluations were done with the examiners masked to the results of the other patient examinations.

The color fundus photographs centered on the macula were obtained with a 30-degree visual field fundus camera (RETINAPAN II, Nikon, Tokyo, Japan). The characteristics of drusen can vary from small dots to large lesions, however, we did not grade them according to the Wisconsin Age-Related Maculopathy Grading System,³ because of the small size of our study population. We simply recorded the presence of drusen.

The deep retinal layers were observed non-invasively using the SLO with a longer wavelength diode laser (780 nm) and confocal and ring apertures. The confocal aperture blocks the scattered light and allows passage only of the images from the focused plane. The ring aperture blocks the directly reflected light from the focused plane and allows passage of the laterally scattered light (indirect imaging).⁶⁻⁹

Differences were analyzed using chi-square analysis. A 5% difference was considered statistically significant.

Results

Drusen were observed photographically in 10 of 17 (58.8%) of the fellow eyes of the Japanese patients with unilateral AMD.

Using SLO infrared indirect imaging, drusen were clearly detected non-invasively as in topographic images (Figs. 1, 2). The number of drusen detected using SLO infrared indirect imaging was much greater than when using photography (Fig. 3). Furthermore, in five patients drusen could be detected only when using SLO infrared indirect imaging and not photographically (Fig. 4). The prevalence of drusen detected based on SLO infrared imaging (15 cases, 88.2%) was significantly greater than when based on photography ($P<0.05$).

Discussion

We found a significant difference in the prevalence of drusen detected based on photography and SLO infrared imaging. The infrared diode laser can penetrate the deep retinal layer to the choroid. In addition, the ring aperture blocks the directly reflected light from the retinal surface and allows passage of the laterally scattered light. The scattered light from the lesion

provides a slight difference in the refracted phase, and it enhances the contrast of the shape of the structure, just as with phase-contrast illumination. With these characteristics, the SLO infrared indirect imaging provides topographic information about the deep retinal layers and subretinal structures, allowing easy visualization of drusen.⁶⁻⁹ When we pick out some druse in each manuscript and do the correlation across each of the figures that we present, some of which appear to be soft rather than hard drusen. These differences might be caused by these characteristics of the SLO infrared indirect imaging. In populations with richly pigmented RPE such as the Japanese, the presence of drusen based on fundus photography might be underestimated, because the RPE may obscure structures in these patients more so than in Caucasian patients.

Furthermore, elderly patients who have drusen also may have media opacity, therefore, fundus photographs may be of poor quality. The infrared laser of the SLO is transmitted through the media opacities better than the flash light of fundus photography and it is scattered less. In addition, the Maxwellian viewing in the SLO can easily avoid the media opacities, which cannot be done using conventional fundus photography. Therefore, SLO infrared imaging is superior to fundus photography for detecting drusen.

Population-based studies using fundus photographs have been performed to study the early changes of AMD.³⁻⁵ The results showed that drusen are a risk factor for AMD.

Therefore, identifying drusen as an early change of AMD is important for planning patient follow-up. However, the occurrence of AMD features based on photographic gradings in a black population has been reported to be less frequent than in a white population.¹⁰⁻¹²

Therefore, racial differences are thought to exist in AMD. In the daily outpatient clinic, drusen are not commonly detected in elderly Japanese patients during the fundus examination. In the present study, we found that only 58.8% of the patients, whose fellow eye was diagnosed with AMD, have drusen based on photographic findings. In the Beaver Dam Eye Study,⁵ a large AMD study, even small drusen were detected in more than 90% of the participants. Our result is much lower than that population-based report, although our subjects had AMD in at least one eye. However, when we examined patients using SLO infrared imaging, the prevalence of drusen increased to 88.2%. The prevalence of drusen in the fellow eye with AMD is much higher than previously speculated in Japanese patients, but it is still lower than in the previous reports of Caucasian patients, therefore, a racial difference between the two groups might exist.

Our results suggest that in Japanese patients the occurrence of drusen might be underestimated because the RPE might obscure the drusen. In Asian individuals such as the Japanese patients in this study, we speculate that drusen might be present more frequently than previously believed due to the limitations of photography high-lighted by this study. Basically,

drusen are defined on clinical criteria. Whether these drusen detected using SLO infrared imaging represent subclinical drusen or other deposits that may not be drusen related is difficult to assess. Therefore, the occurrence of drusen might be overestimated in this study. However, the prevalence of drusen is still lower than that of a Caucasian population despite use of a more sensitive method. The number of cases in this study is too small to reach definitive conclusions, however, the results suggest that there may be a racial difference between Caucasian and Asian patients.

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Legends

Figure 1. Typical soft drusen. (A) Photography. (B) SLO infrared confocal imaging. (C) SLO infrared indirect imaging. Using the SLO infrared indirect imaging, drusen are clearly detected as in topographic imaging.

Figure 2. Typical hard drusen. (A) Photography. (B) SLO infrared confocal imaging. (C) SLO infrared indirect imaging. With the SLO, drusen can be detected easily using both infrared confocal imaging and infrared indirect imaging.

Figure 3. Number of drusen. (A) Photography. (B) SLO infrared confocal imaging. (C) SLO infrared indirect imaging. The number of drusen detected using SLO infrared indirect imaging is much greater than when using photography.

Figure 4. Occult drusen. (A) Photography. (B) SLO infrared confocal imaging. (C) SLO infrared indirect imaging. Drusen can be detected only when using SLO infrared indirect imaging.











