WAYFINDING AI: A NEW WAY TO DETECT RETINAL DISEASE

A new approach may one day help clinicians better identify abnormalities overlooked with current imaging modalities.

By Taiji Sakamoto, MD; Shozo Sonoda, MD, PhD; and Hideki Shiihara, MD



Artificial intelligence (AI) is attracting attention for its potential to enable highly accurate diagnoses.[1-3] Still, a major drawback of AI is its inability to demonstrate the specific clinical findings that are the basis of the diagnosis, known as the *black box effect*.[2-5] To overcome this, researchers began adding heatmaps to diagnostic images to provide some idea of the reference area.[6] However, this is only a complement to AI diagnosis, not diagnostic evidence. The black box effect remains a significant challenge to the implementation of AI.

WAYFINDING AI

Giving a final diagnosis from the beginning with no indication of how that decision was made does not inspire confidence in the clinician. This is because it is the clinician who is ultimately responsible for the diagnosis, and physicians believe that they cannot take responsibility for an AI diagnosis for which the reasoning is unclear.

To help address this issue, Adler-Milstein et al proposed a new concept for next-generation diagnostics, termed *wayfinding AI*.[7] This algorithm understands the diagnostic process and provides clues to guide the clinician. Specifically, wayfinding AI is designed to identify the location of retinal abnormalities to assist physicians in the decision-making process on the journey to a diagnosis and treatment plan.

To assess this approach, we used wayfinding AI to quantify the ambiguity of the boundary of each layer of the retina.[8] Using entropy, the AI model identified the boundary of each layer and labeled areas in which the boundary was not certain. We used that data to create a heatmap of each layer, which made it possible to detect abnormal areas quickly and with pinpoint accuracy. The areas highlighted by the OCT heatmaps can help the clinician make the correct diagnosis.

One significant benefit is that the tool detects anomalies using entropy, which does not require high computational cost compared with previous methods. Recently, a similar AI algorithm was developed to identify the location of findings, such as pigment epithelial detachment, on OCT images of AMD suspects.[9] However, the algorithm requires a large graphic processing unit and is time-consuming. Our algorithm is simple, can be implemented using current OCT machines, and requires less computation time (Figure 1).

CLINICAL IMPLICATIONS

In practice, clinicians must carefully but quickly review many OCT image slices to identify abnormal areas of the retina. Thus, it can be difficult to detect new lesions, especially small or subtle ones, that appear in areas beyond the main lesion. However, small and often overlooked lesions may be precursors to major changes.

The wayfinding AI heatmap can help the clinician review the entire area quickly by providing a rough distribution of lesions. In our experience, this has greatly reduced the number of missed abnormal areas (Figure 2).[8] Once an abnormal area is discovered, the clinician can plan management accordingly. Above all, the clinician, not the AI, is responsible.

GUIDING DIAGNOSES

Wayfinding AI is not yet clearly defined. However, the wayfinding AI in our study is designed to help clinicians reach

AT A GLANCE

- A major drawback of artificial intelligence (AI) is its inability to demonstrate the specific clinical findings that are the basis of the diagnosis,
- Wayfinding AI identifies retinal abnormalities to assist in the decision-making process.
- The authors' wayfinding AI model creates a heatmap of each retinal layer to identify abnormal areas.

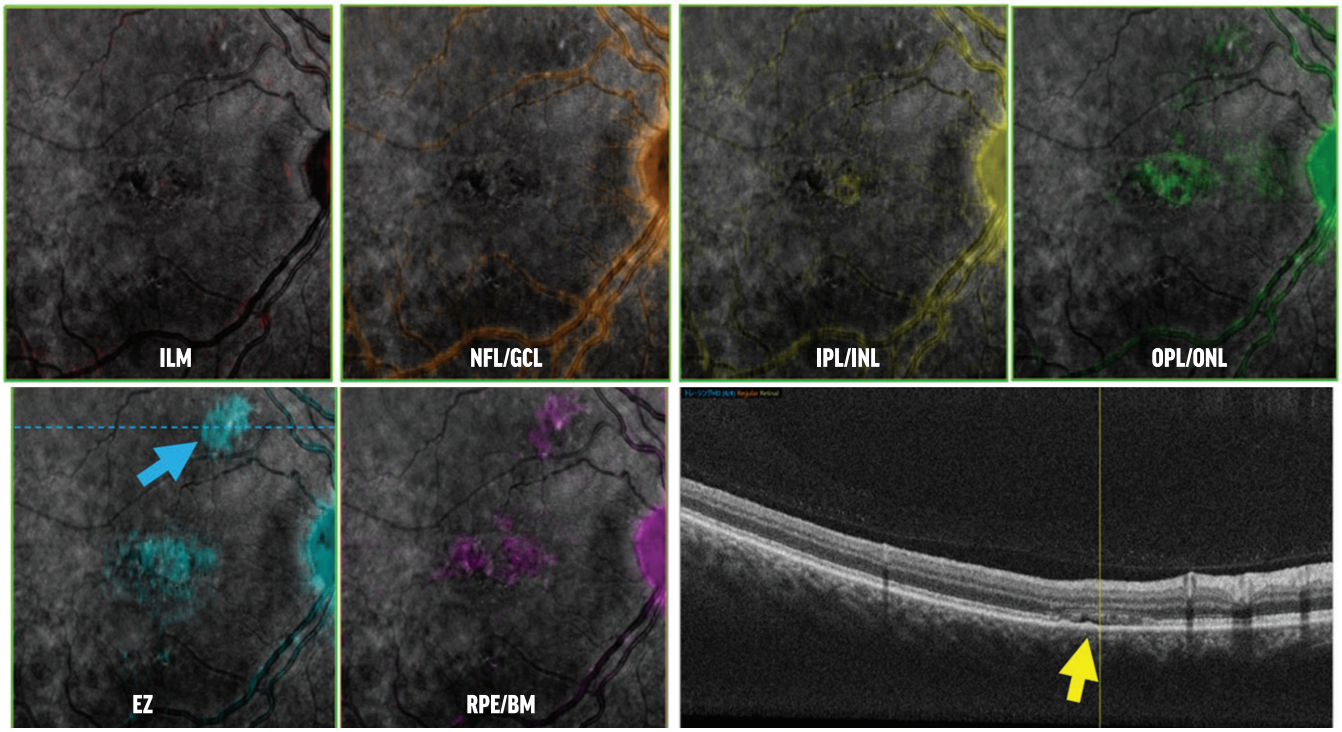

Figure. A case of central serous chorioretinopathy imaged with our novel AI algorithm. Although a macular lesion dominates the clinician's attention with traditional imaging, the wayfinding AI algorithm reveals another abnormal area in the ellipsoid zone layer (bottom left, blue arrow). The OCT B-scan (dashed line) also showed the abnormality in the ellipsoid zone layer (bottom right, yellow arrow). When the main lesion is obvious, other small lesions tend to be overlooked, which can be prevented by implementing this AI algorithm.

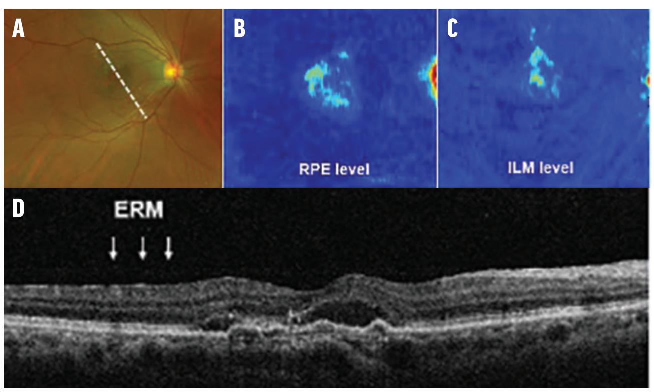

Figure 2. This patient with AMD was being followed with a focus on the subretinal tissue in the macular region (A). However, wayfinding AI revealed abnormalities at the level of the RPE (B) and the ILM (C). The OCT scan (dashed line scan, A), revealed an overlooked ERM (D). Reprinted with permission from Shiihara H et al. *PloS One*.[8]

the correct diagnosis by reviewing areas of retinal abnormalities, rather than providing a final diagnosis. The proposed AI is a novel tool that may be more easily accepted by clinicians than current AI models, which remain limited by the black box effect. Over-reliance on AI can lead to misdiagnosis, something wayfinding AI may be able to prevent. ■

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TAIJI SAKAMOTO, MD
- Chair, Department of Ophthalmology, Kagoshima University Graduate School of Medical and Dental Sciences, Kagoshima, Japan
- tsakamot@m3.kufm.kagoshima-u.ac.jp
- Financial disclosure: Consultant (Bayer, Behringer, Chugai, Nidek, Nikki, Nikon, Novartis, Santen, Senju)

HIDEKI SHIIHARA, MD
- Department of Ophthalmology, Kagoshima University Graduate School of Medical and Dental Sciences, Kagoshima, Japan
- Financial disclosure: None

SHOZO SONODA, MD, PHD
- Department of Ophthalmology, Kagoshima University Graduate School of Medical and Dental Sciences, Kagoshima, Japan
- Financial disclosure: Consultant (Nidek, Nikon)