Photo Essay

Autofluorescence and Infrared Fundus Imaging for Detection of Retinal Emboli and Unmasking Undiagnosed Systemic Abnormalities

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PRESENTATION

Case 1

A 31-year-old healthy man presented with sudden onset visual field defect in his left eye for 2 days. The best-corrected visual acuity (BCVA) was 20/20 in the right eye and 20/40 in the left eye. Fundus examination of the left eye revealed a superior hemi-central retinal artery occlusion [Figure 1a], sparing the fovea with a white embolus at the arterial bifurcation on the optic nerve head. The embolus was visible on both red free and infrared imaging. However, fundus autofluorescence imaging revealed a corresponding bright hyperautofluorescent lesion within a vessel at the optic nerve head, suggestive of a probable calcific embolus [Figure 1b]. Immediate referral to a cardiologist and a subsequent 2D echocardiogram revealed severe calcific aortic stenosis, which was rectified with early aortic valve replacement surgery.

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Case 2

A 68-year-old diabetic lady with sudden onset blurring of vision in her left eye for 2 weeks had a BCVA of 20/20 in the right eye and 20/40 in the left eye. Fundus examination of the left eye revealed an inferior branch retinal arterial occlusion, sparing the fovea with an intra-arterial embolus at the disc [Figure 2a]. Fundus autofluorescence imaging, though slightly hazy due to cataract, showed corresponding hyperautofluorescence, suggesting the calcific nature of the embolus [Figure 2b]. The patient was immediately referred to a cardiologist and underwent left carotid artery stenting because her computerized tomography (CT) carotid angiogram revealed a concentric calcific plaque in the left carotid bulb with more than 70% stenosis.

Case 3

A healthy 69-year-old man with BCVA of 20/20 in both eyes and recent amaurosis fugax in the right eye was clinically diagnosed with a small yellowish-white embolus in the retinal artery on fundus examination [Figure 3a], which was visible as a hyperreflective lesion on OCT imaging [Figure 3b] and on infrared reflectance imaging [Figure 3c] but undetectable on fundus autofluorescence [Figure 3d]. Clinically, there was no evidence of retinal artery

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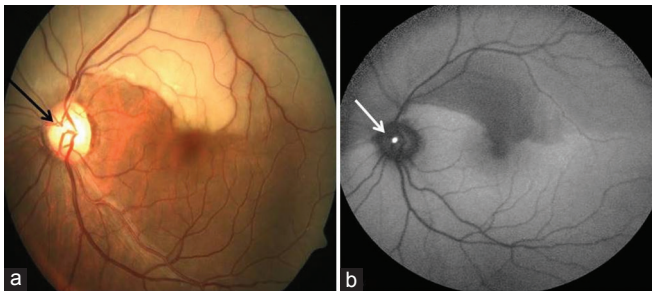

Figure 1. A superior hemi-central retinal artery occlusion sparing the fovea with a white embolus at the arterial bifurcation is visible on color fundus photograph (black arrow) (a) and reveals corresponding hyperautofluorescence on autofluorescence imaging (white arrow) (b).

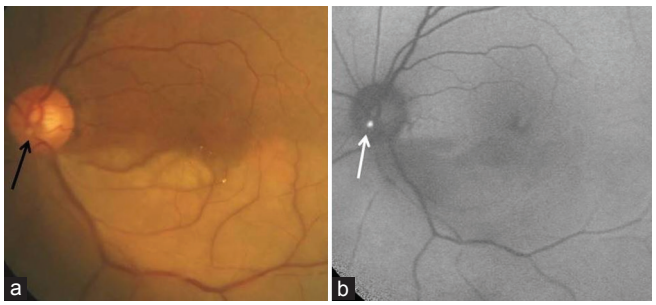

Figure 2. Color fundus photograph of the left eye (a) of an elderly lady revealing an inferior branch retinal artery occlusion, just sparing the fovea with a cream colored embolus faintly visible at the optic nerve head (black arrow). Fundus autofluorescence (b) imaging, though slightly blurred due to cataract, reveals hyperautofluorescence corresponding to the embolus on the disc (white arrow).

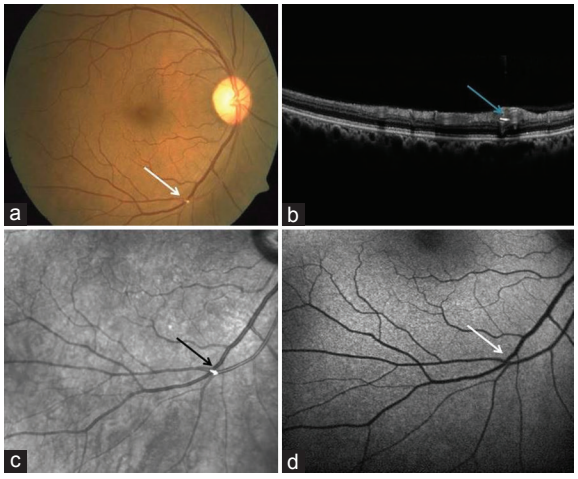

Figure 3. A yellowish white embolus in the retinal artery on color fundus photograph (white arrow) (a) is visible as a hyperreflective lesion (blue arrow) on OCT imaging (b) and a hyperreflective lesion (black arrow) on infrared reflectance imaging (c) but is undetectable on autofluorescence (d).

occlusion. Preliminary systemic evaluation was normal except for elevated lipids (total cholesterol: 261 mg/dl, low-density lipoprotein: 187 mg/dl) and minimal atherosclerotic changes in the carotid vessels. Lipid-lowering agents were started immediately and a regular follow-up was advised.

DISCUSSION

Fundus autofluorescence imaging is an effective noninvasive tool for detection of calcium emboli in retinal artery occlusion. Sartori et al[1] and Erol et al[2] have shown the autofluorescent properties of calcium. Siddiqui et al[3] and Munk et al[4] have also reported similar autofluorescence findings in arterial occlusions wherein the embolus was not clinically visible on fundus examination. A calcific embolus once diagnosed necessitates urgent investigations to unmask underlying cardiac or carotid etiologies which can be life-threatening.

Near-infrared imaging modality is being widely used for detection of lipid content in coronary plaques.[5,6] In Case 3, there was the clinical suspicion of a small calcium or cholesterol embolus as it did not appear like a fibrinoplatelet embolus. Lack of hyperautofluorescence ruled out the possibility of any calcific embolus. As the embolus was visible on infrared imaging, we considered the possibility of a cholesterol embolus, which was further supported by an elevated lipid profile with atherosclerotic changes in carotids and absence of any calcific systemic source.

Though lack of histopathologic diagnosis is the main limitation in our cases, the supportive systemic evidence proves the utility of fundus autofluorescence and infrared fundus imaging as two noninvasive and fast imaging techniques in detecting asymptomatic or atypical emboli - even before vascular occlusion occurs. Furthermore, the ability of these imaging techniques to locate the precise point of embolus may also pave the way for better treatment modalities in the future.

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Conflicts of Interest

There are no conflicts of interest.

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