Photo Essay

Multimodal imaging of choroidal tubercles

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Key words: Choroidal tubercles, enhanced depth imaging spectral-domain optical coherence tomography, fundus autofluorescence imaging, near-infrared reflectance imaging

Case Report

A 39-year-old woman with disseminated tuberculosis and bilateral solitary choroidal tubercles [Fig. 1a and b] was subjected to multimodal imaging including enhanced depth imaging spectral-domain optical coherence tomography (EDI-OCT), near-infrared reflectance (NIR), and fundus autofluorescence (FAF) imaging. FAF imaging revealed hyperautofluorescent lesion with central hypoautofluorescence [Fig. 1c and d]. NIR imaging revealed hyperreflective lesion with a hyporefl ective halo [Fig. 2a and c]. EDI-OCT [Fig. 2b and d] showed lobulated hypo/isoreflective choroidal lesion with loss of vascular pattern and dome-shaped elevation of the overlying retina. Characteristic "increased transmission effect" was seen beneath the lesion. A small cap of subretinal fluid at the apex of lesion was noted in the right eye. Antituberculous therapy resulted in systemic improvement and regression of choroidal tubercles [Figs. 3 and 4 a-i].

Discussion

Characterization of choroidal lesions has evolved with the advent of modalities that enable imaging of the choroid and sclera (EDI-OCT); melanin, collagen, or fibrin (NIR imaging), and fluorophores (FAF).[1-5] EDI-OCT enabled morphological evaluation of lesions, precise localization and measurement, and monitoring during treatment. NIR imaging which provided high-resolution enface images of subretinal pathologies demonstrated choroidal tubercles as hyperreflective due to unmasking of scleral collagen caused by defective choroidal pigmentation. There is only a single report of FAF imaging of choroidal tubercle.[6] Acute lesion was hyperautofluorescent due to increased lipofuscin in the diseased retinal pigment epithelium (RPE), and the central hypoautofluorescence could be due to absent RPE, sparse lipofuscin, or secondary retinal infiltration. Posttreatment lesion may become iso/hypoautofluorescent. This FAF pattern is distinct from the heterogeneous appearance of choroidal metastasis, amelanotic melanomas, or nevus which results from lipofuscin, fluid, or RPE atrophy.[6] Thus, combined imaging helped to evaluate and monitor the chorioretinal pathology noninvasively in our patient with choroidal tubercles. Immunohistochemical studies of excised tuberculous pulmonary granulomas have shown that increased accumulation of lipid-rich caseum in the granulomas due to dysregulation in the host lipid metabolism signifies the progression of latent disease to active infection.[7] Further studies with FAF might help to detect similar changes in choroidal granulomas *in vivo* and thus obtain valuable insights into our understanding of ocular tuberculosis.

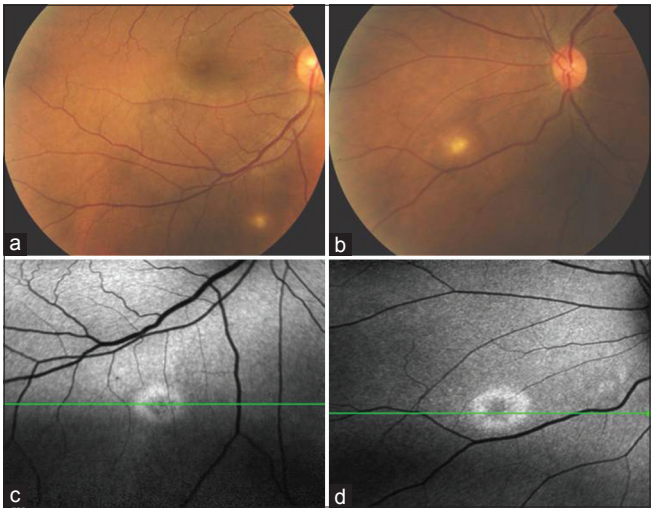

Figure 1: Color fundus photograph at presentation showed the solitary yellowish choroidal nodules inferiorly in the right eye (a) and nasally in the left eye (b). Corresponding fundus autofluorescence imaging showed the lesion as hyperautofluorescent with central hypoautofluorescence (c and d)

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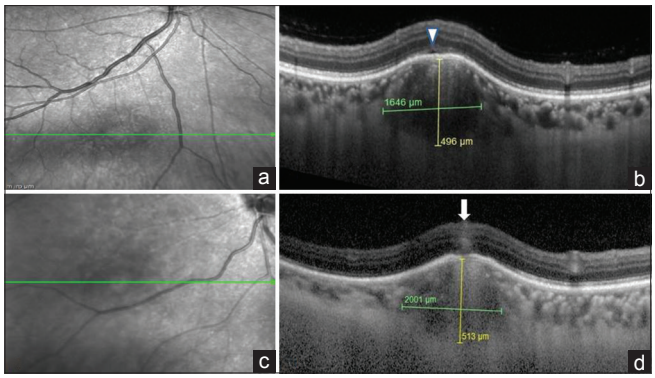

Figure 2: Near-infrared reflectance imaging at presentation showed faintly hyperreflective lesion with a hyporeflective halo in both the eyes (a and c). Enhanced depth imaging spectral-domain optical coherence tomography (b and d) showed lobulated hypo/isoreflective choroidal lesion of dimensions as noted with loss of typical vascular pattern and dome-shaped elevation of overlying retina. A tiny pocket of subretinal fluid at the apex of the lesion (arrowhead) was noted in the right eye, and hyperreflective infiltrate with localized disruption of the outer retina and retinal pigment epithelium (arrow) was noted in the left eye suggestive of activity. Lesion was larger and nonhomogeneous in the left eye

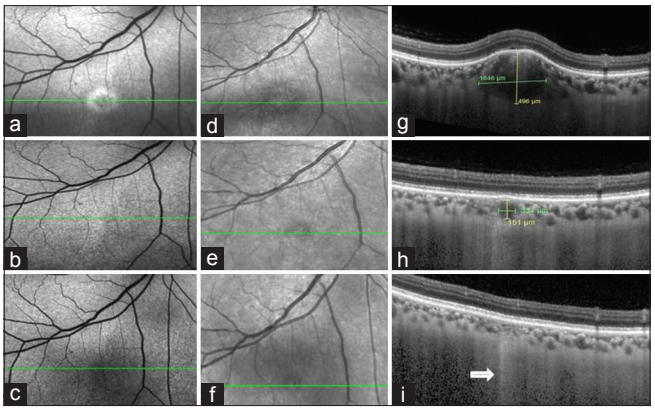

Figure 3: Multimodal imaging of the right eye at presentation, 2 months, and 9 months posttreatment is shown in the top, middle, and bottom rows, respectively. On fundus autofluorescence imaging (a-c), the hyperautofluorescent lesion regressed to a faint isoautofluorescent scar. Near-infrared reflectance imaging (d-f) showed mildly hyperreflective lesion with a dark halo at baseline which regressed with treatment. Enhanced depth imaging spectral-domain optical coherence tomography scans (g-i) demonstrated resolution of the tubercle with treatment, restoring the normal choroidal architecture. Increased signal transmission effect was seen beneath the lesion (arrow)

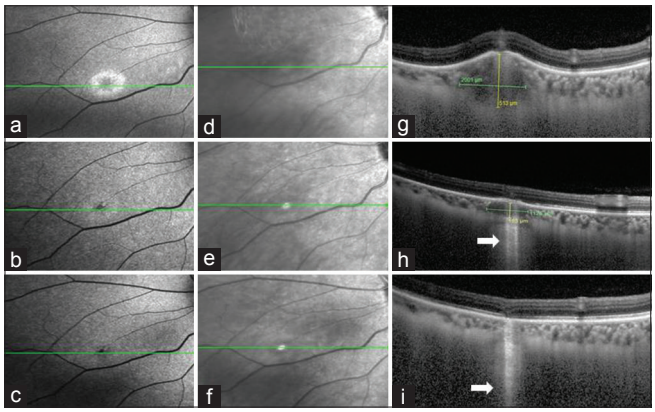

Figure 4: Multimodal imaging of the left eye at presentation, 2 months, and 9 months posttreatment is shown in the top, middle, and bottom rows, respectively. On fundus autofluorescence imaging (a-c) the hyperautofluorescent lesion regressed to a hypoautofluorescent scar. Near-infrared reflectance imaging (d-f) showed transition of mildly hyperreflective lesion with a dark halo at baseline to a more hyperreflective fibrous scar. Enhanced depth imaging spectral-domain optical coherence tomography scans (g-i) demonstrated resolution of the tubercle with treatment. Hyperreflective retinal infiltrate resolved, but irregularity of the outer retina and retinal pigment epithelium with increased transmission effect persisted (arrow)

Conclusion

Distinct FAF features (hyperautofluorescent with central hypoautofluorescence) may help diagnose choroidal tubercles and differentiate from other simulating clinical conditions.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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