Three-dimensional spectral domain optical coherence tomography of retina in choroidal metastasis due to breast and lung carcinoma

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Introduction

Intraocular metastasis is now considered the most common malignancy of the eye [1]. The frequency of choroidal metastasis in patients with cancer is estimated to be approximately 2 to 7 % [2, 3]. While any portion of the eye can be involved by metastatic disease, the most common tissue involved is the highly vascular choroid [1–3]. There seems to be no predilection for metastasis to preferentially affect the right or left eye [3]. In each affected eye, more than one metastasis may be noted [4]. Most choroidal metastases occur posterior to the equator of the fundus, in the macular or paramacular regions.

The common primary sites of cancer are the breast, lung, and gastrointestinal tract [2, 3]. Diagnosis of ocular metastases is based primarily on clinical findings supplemented by imaging studies. Spectral domain optical coherence tomography (SD-OCT) clearly outlines the changes in the retinal architecture due to the underlying choroidal mass. 3D SD-OCT feature of retina following choroidal metastasis due to uterine endometrial carcinoma has been reported by Saxena et al. [5]. 3D SD-OCT in choroidal metastasis due to breast and lung carcinoma is being reported for the first time.

Material and methods

The authors confirm adherence to the tenets of the Declaration of Helsinki. After taking a written informed consent, spectral domain optical coherence tomography (Optopol, Poland) was performed in two patients with breast and lung carcinoma with choroidal metastasis.

Case 1

A 54-year-old female presented to the outpatient department of our tertiary care center with complaints of painless diminution of vision in her left eye since 20 days. She had undergone mastectomy for breast cancer 5 years back and had taken chemotherapy for the same. On examination, vision in the right eye was 20/20 and in the left eye was counting finger at 3 m. Anterior segment examination was unremarkable. Fundus examination of the right eye revealed no abnormality. In the left eye, fundus examination revealed a mass superotemporal to the disc measuring around 7 disc diameter (DD) in its greatest dimension with serous detachment involving the macula. Retinal striae were seen around the macula (Fig. 1). Fluorescein angiography showed hyperfluorescence, in the arteriovenous phase, with surrounding transmission defects (Fig. 2a). During venous phase, there was leakage of dye and staining of the mass (Fig. 2b). 3D-OCT was performed over the tumor mass. OCT scan in the *x*-axis along with false color-coded map showed retinal elevation associated with serous neurosensory retinal detachment. Two pockets of serous fluid were observed. Retinal pigment epithelium (RPE) was found to be hyperplastic with proliferating RPE cells studded over its surface. Outer photoreceptor layer showed presence of granularity with

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Fig. 1 Fundus photograph of the left eye showing a mass superotemporal to the disc measuring around 7 DD in its greatest dimension with serous detachment involving the macula. Retinal striae are seen around the macula

low reflective particles seen over the area of neurosensory detachment (Fig. 3). The patient underwent treatment with external beam radiotherapy. At 6 weeks follow-up, the fundus of the left eye showed resolving tumor mass with alterations in

Fig. 2 **a** Fluorescein angiogram in the arteriovenous phase showing hyperfluorescence, with surrounding transmission defects. **b** Fluorescein angiogram in the venous phase, showing leakage of dye and staining of the mass

Fig. 3 OCT scan in the x-axis along with false color-coded map showing retinal elevation associated with serous neurosensory retinal detachment. Two pockets of serous fluid are seen. RPE is hyperplastic with proliferating RPE cells (*arrowhead*) studded over its surface. Outer photoreceptor layer shows presence of granularity (*arrow*) with low reflective particles seen over the area of neurosensory detachment

the RPE at macula (Fig. 4). The vision was maintained at counting finger at 3 m.

Case 2

A 58-year-old male presented to the outpatient department of our tertiary care center with complaints of decreased visual acuity in his right eye since 1 month. He was receiv-

Fig. 4 Fundus photograph of the left eye posttreatment showing resolving tumor mass with alterations in the RPE at macula

Fig. 5 Fundus photograph of the right eye showing a large choroidal mass around 8 DD in its greatest dimension, situated 1 DD temporal to the disc and involving the macula. Pigmentary changes in the form of leopard skin pigmentation are seen in the periphery of the mass

Fig. 7 Fundus photograph of the right eye at 6 weeks follow-up showing subretinal and subhyaloid hemorrhages along the margins of the tumor mass. The mass is markedly elevated

ing radiotherapy and chemotherapy for non-small cell lung cancer with brain metastasis. His best corrected visual acuity in the right eye was hand movement and in the left eye was 20/20. Anterior segment examination was unremarkable. Fundus examination of the left eye revealed no abnormality. The fundus of the right eye showed a large choroidal mass

Fig. 6 **a** Fluorescein angiogram in the early arteriovenous phase showing hyperfluorescence over the tumor mass with blocked fluorescence at places superiorly. **b** Fluorescein angiogram in the late phase showing staining along with blocked fluorescence

around 8 DD in its greatest dimension, situated 1 DD temporal to the disc and involving the macula. Pigmentary changes in the form of “leopard skin pigmentation” were seen in the periphery of the mass (Fig. 5). Fluorescein angiogram was performed. During the early arteriovenous phase, there was hyperfluorescence seen over the tumor mass with blocked fluorescence at places superiorly (Fig. 6a). Late phase of the angiogram showed staining along with blocked fluorescence (Fig. 6b). The patient was advised to continue his treatment. At 6 weeks follow-up, the vision in the affected eye further deteriorated to perception of light. The fundus revealed subretinal and subhyaloid hemorrhages along the margins of the tumor mass. The mass was now markedly elevated (Fig. 7). False color-coded retinal thickness map on 3D-OCT revealed marked retinal elevation over the irregular tumor mass (Fig. 8a). False color-coded RPE map over the tumor mass showed irregularly elevated and disfigured RPE (Fig. 8b). Despite extensive treatment, the patient expired 3 months after the initial presentation.

Discussion

Choroidal metastasis has been frequently described in breast and lung cancers. Ferry and Font [6] speculated that the distribution of tumors within the choroid may be related to its vascular characteristics. There is abundant supply of posterior ciliary arteries to the choroid, especially the posterior choroid. The numerous posterior ciliary vessels allow a greater flow of tumor emboli to the posterior uvea as compared to the fewer anterior ciliary vessels supplying the anterior uvea. Metastatic disease involving the uvea should be considered particularly when the patient has a known primary malignancy.

Fig. 8 **a** False color-coded retinal thickness map on 3D-OCT showing marked retinal elevation over the irregular tumor mass. **b** False color-coded RPE map on 3D-OCT over the tumor mass showing irregularly elevated and disfigured RPE

Optical coherence tomography features for choroidal metastasis following breast and lung carcinoma have been reported by Arevalo et al. [7]. They found anterior displacement of the photoreceptor layer by subretinal fluid overlying

a hyperreflective thickened retinal pigment epithelium–choriocapillaris complex. Subretinal deposits with several degrees of hyperreflectivity were seen. Loss of normal retinal architecture with intraretinal splitting within the neurosensory retina was also reported. Pérez-Alvarez et al. [8] found OCT to be a useful tool for follow-up of choroidal metastasis after treatment. However, its use was limited due to initial choroidal location of the metastasis.

We report 3D imaging of breast and lung carcinoma choroidal metastasis on SD-OCT for the first time. In breast carcinoma, serous neurosensory retinal detachment was observed. Hyperplastic RPE along with proliferating RPE cells was also noted. Outer photoreceptor layer showed presence of granularity. These features indicate the chronicity of the underlying tumor mass abutting the retina. Low reflective particles seen over the area of neurosensory detachment could probably indicate macrophages with phagocytized photoreceptors. In lung carcinoma, marked irregular retinal elevation along with RPE irregularity was observed secondary to the underlying proliferating tumor mass. Three-dimensional SD-OCT simplifies the documentation of the disease and allows evaluation of secondary retinal changes.

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