

Multimodal imaging of retinal astrocytic hamartoma in two patients with tuberous sclerosis complex

Imagem multimodal do hamartoma astrocítico da retina em dois pacientes com complexo de esclerose tuberosa

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ABSTRACT

Objective: To report the imaging methods used in the identification of retinal astrocytic hamartomas in two patients with Tuberous Sclerosis Complex. **Methodology:** Two female patients diagnosed with Tuberous Sclerosis Complex and retinal astrocytic hamartomas underwent ophthalmological and imaging exams, including color fundus photography, fluorescein angiography, optical coherence tomography (OCT), and optical coherence tomography-angiography (OCT-A). **Results:** Both patients presented retinal lesions characteristic of astrocytic hamartomas. OCT images revealed hyperreflective masses with retinal disorganization and the characteristic moth-eaten spaces. OCT-A showed increased vasculature within the lesions. **Conclusion:** Multimodal imaging, including OCT and OCT-A, proved useful in the detailed evaluation of retinal astrocytic hamartomas in patients with Tuberous Sclerosis Complex.

Keywords: Tuberous Sclerosis. Optical Coherence Tomography. Fluorescein Angiography. Retina.

RESUMO

Objetivos: Relatar os métodos de imagem utilizados na identificação de hamartomas astrocíticos da retina em dois pacientes com Complexo de Esclerose Tuberosa. **Metodologia:** Dois pacientes do sexo feminino, com diagnósticos de Complexo de Esclerose Tuberosa e hamartomas astrocíticos da retina foram submetidos a exames oftalmológicos e de imagem, incluindo retinografia colorida, angiografia fluoresceínica, tomografia de coerência óptica (OCT) e tomografia de coerência óptica-angiografia (OCT-A). **Resultados:** Ambos os pacientes apresentaram lesões retinianas características do hamartoma astrocítico. As imagens de OCT revelaram massas hiper-reflectivas com desorganização retiniana e as áreas características de “mordida de traça”. A OCT-A mostrou aumento da vascularização nas lesões. **Conclusão:** A imagem multimodal, incluindo OCT e OCT-A, demonstrou ser útil na avaliação detalhada dos hamartomas astrocíticos da retina em pacientes com Complexo de Esclerose Tuberosa.

Palavras-chave: Esclerose Tuberosa. Tomografia de Coerência Óptica. Angiofluoresceinografia. Retina.



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INTRODUCTION

Tuberous Sclerosis Complex (TSC) is a genetic disorder characterized by the development of benign tumors, known as hamartomas, which affect multiple organs such as the kidneys, brain, skin, heart, lungs, and eyes.¹ It is caused by inactivating mutations in the TSC1 or TSC2 genes.² The classic triad of symptoms includes epilepsy, intellectual disability, and adenoma sebaceum.³

Ocular manifestations of TSC include retinal astrocytic hamartoma (RAH), retinal pigment epithelial (RPE) "punched-out" achromic patches, angiofibromas of the eyelids, and hypopigmented sectoral lesions of the ciliary body and iris.⁴ Retinal hamartomas may appear as calcified multinodular lesions with a mulberry-like appearance or as flat, translucent, whitish lesions.¹ These hamartomas are generally benign, although complications such as macular edema, retinal detachment, and vitreous hemorrhage have been reported.⁵

The typical retinal lesions are usually detected by ophthalmoscopy; however, color fundus photography, infrared fundus photography, fluorescein angiography, and optical coherence tomography (OCT) provide valuable imaging data for diagnosis. Both spectral-domain (SD) and swept-source (SS) OCT show optically empty spaces, often referred to as "moth-eaten" areas, which are attributed to intralésional calcification or cavitation.⁶ Optical coherence tomography angiography (OCT-A) offers a non-invasive method to visualize retinal vasculature in detail.

This study reports on two patients with TSC and their respective retinal imaging findings, with a focus on multimodal imaging techniques, including OCT and OCT-A, in the evaluation of retinal astrocytic hamartomas.

CASE SERIES

Case 1

A 27-year-old female presented with occasional light headaches and a long history of hyperpigmented papules on the face suggestive of sebaceous adenomas, as well as shagreen patches in the dorsal region. She had been using antiepileptic drugs since birth due to seizures. Ophthalmoscopy revealed a yellowish lesion in the temporal region of the right eye (OD) measuring about one disc diameter, and a yellowish-white lesion in the nasal equatorial region of the left eye (OS) measuring approximately two disc diameters, suggestive of retinal astrocytoma. Fluorescein angiography (Image 1) showed hyperfluorescence of the lesions. OCT displayed typical dome-shaped hyperreflective masses with retinal disorganization, posterior shadowing, and moth-eaten spaces. OCT-A (Image 2) revealed increased vascularization in the lesions.

Case 2

A 33-year-old female was diagnosed with retinal lesions in both eyes during a routine examination. She had a history of childhood seizures and had undergone a right nephrectomy due to benign renal tumors, likely angiomyolipomas. Ophthalmoscopy revealed a yellowish-white, elevated hamartoma located near the temporal region of the optic disc in the right eye (OD), measuring about one disc diameter. In the left eye (OS), a flat yellowish lesion was observed above the optic disc and along the upper and lower temporal vascular arcades, also measuring about one disc diameter. The anatomical fovea and retina were intact. Fluorescein angiography (Image 3) indicated hyperfluorescence of the lesions. OCT (Image 4) showed typical dome-shaped hyperreflective masses with retinal disorganization and moth-eaten spaces, while OCT-A confirmed increased vascularity within the lesions.

Image 1. Yellowish lesion on the nasal area and fluorescein angiography showing hyperfluorescence.

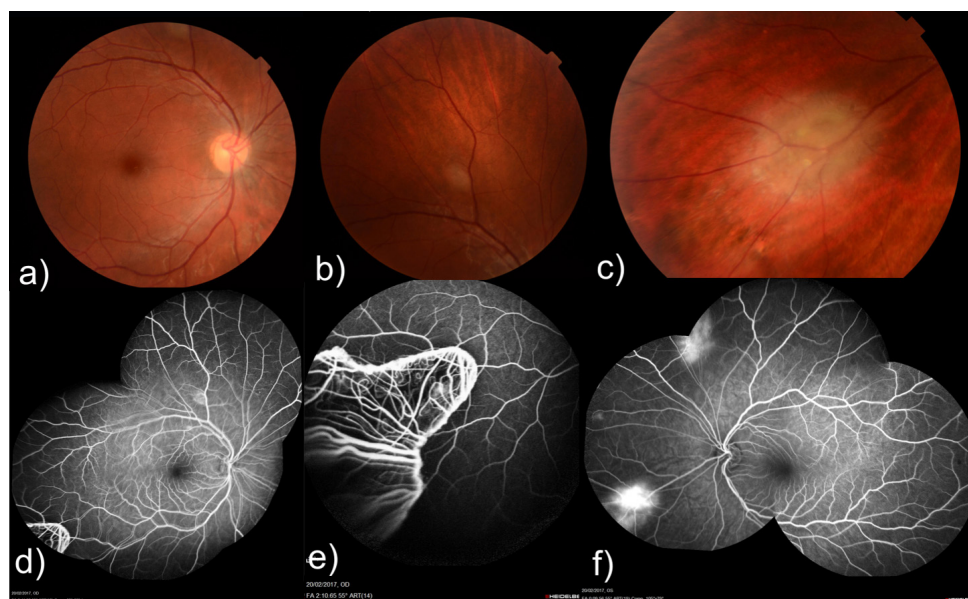


Image 2. OCT-A image revealing increased vascularisation in the lesion.

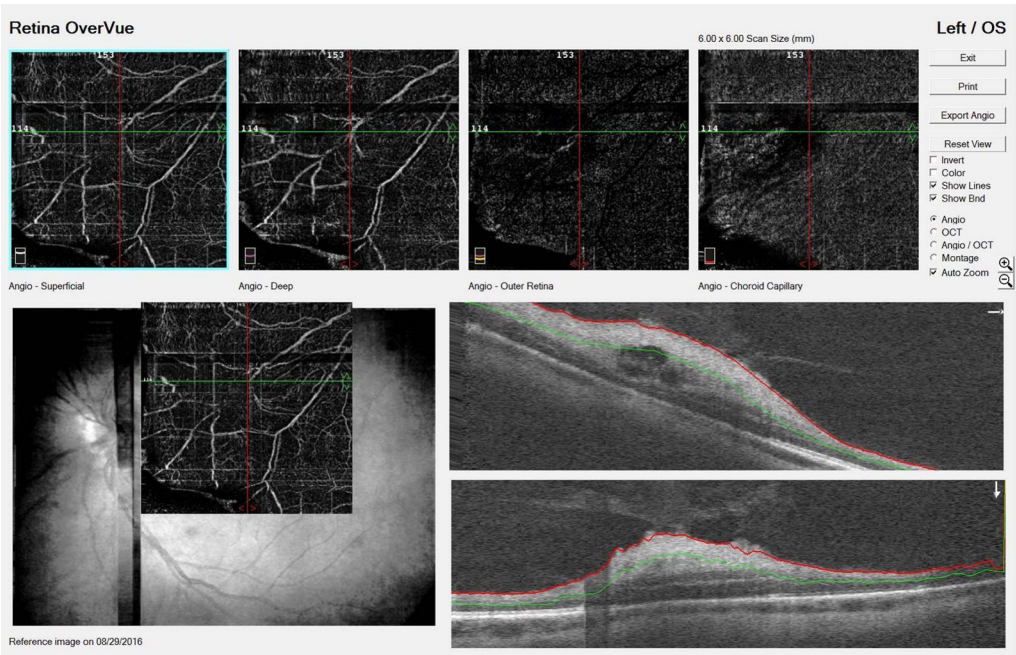


Image 3. Yellowish lesions in both eyes on retinography.

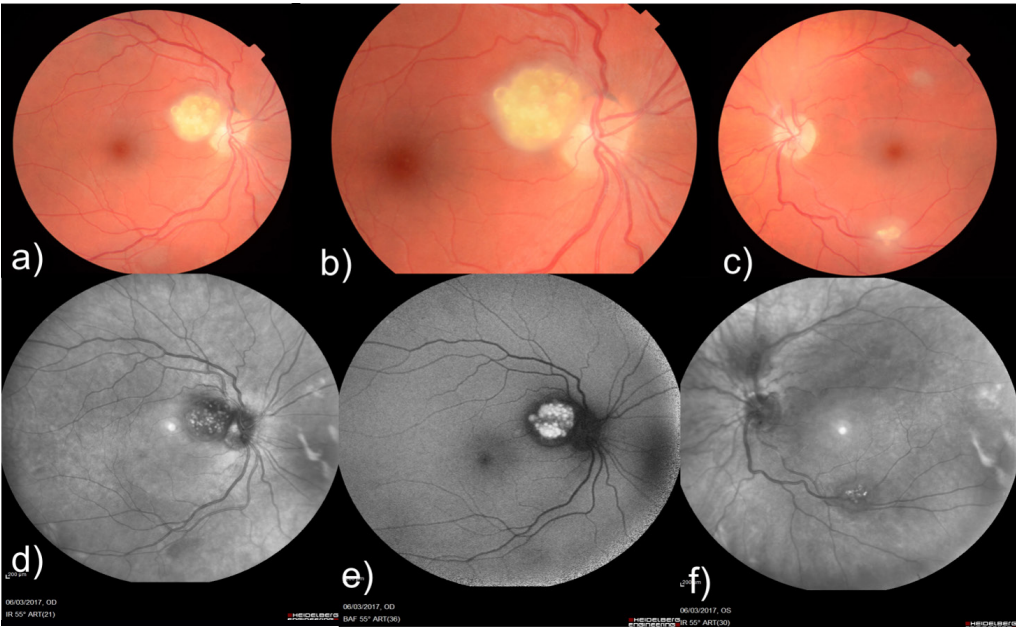
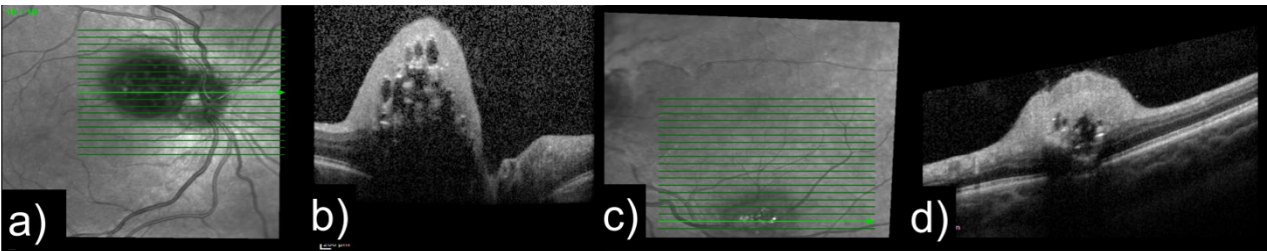


Image 4. OCT image showing dome-shaped hyperreflective masses and moth-eaten spaces.



DISCUSSION

Tuberous Sclerosis Complex is a multisystem disorder characterized by the development of hamartomas. Retinal astrocytic hamartomas are a hallmark ocular manifestation and can be the first sign of the disease, occurring in up to 50% of patients.^{3,5} Bilateral hamartomas are present in approximately 30% of cases.⁴

Retinal hamartomas are divided into three basic morphological types: smooth, relatively flat, non-calcified lesions with oval or circular shapes (referred to as “younger tuberous bodies”), elevated, calcified, multinodular lesions with a mulberry-like appearance (referred to as “older tuberous bodies”), and transitional lesions that exhibit features of both types.⁴ Flat lesions are the most common, presenting as gray or yellow, translucent areas with indistinct margins. Classic multinodular lesions are sharply demarcated, nodular, and described as “mulberry” or “fish eggs” in appearance. Calcifications can be detected on B-scan ultrasonography as hyperechogenic areas with posterior shadowing, and on CT scans.¹

Though retinal hamartomas are typically stationary, aggressive cases with tumor growth have been reported. Shields et al. documented a series of patients with TSC and progressive retinal neoplasms, where four cases required enucleation due to a blind, painful eye.⁵

OCT is a valuable tool in detecting retinal hamartomas, showing typical dome-shaped, hyperreflective masses with moth-eaten spaces. Shields et al. reported this finding in 15 patients with

RAH.⁶ Pichi et al. further classified RAH based on tumor size, retinal traction, and the presence of optically empty spaces, using spectral-domain OCT.^{7,8} Recently, Shield et al. described specific features of astrocytic hamartomas in a study of 47 eyes, correlating these features with tumor size and location.⁹

OCT-A provides additional insights into the vasculature of the lesions, allowing the precise mapping of increased vascularity. This imaging modality has proven useful in distinguishing between younger, less vascularized lesions and older, more complex hamartomas.

Other ocular findings in TSC include hypopigmented sectoral lesions of the iris and ciliary body, colobomas of the iris and choroid, and angiofibromas of the eyelids.³ Retinal depigmented patches, likely representing flat astrocytic hamartomas or RPE “punched-out” depigmentation, have also been noted.⁹

Treatment for retinal hamartomas in TSC is usually unnecessary unless complications arise. Aggressive lesions are rare but may require enucleation if associated with a painful blind eye.

CONCLUSION

Multimodal imaging, particularly with OCT and OCT-A, plays a crucial role in the diagnosis and management of retinal astrocytic hamartomas in TSC patients. These imaging techniques provide detailed information about the structural and vascular characteristics of the lesions, aiding in their classification and monitoring.

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