

OCT And Autofluorescence: Are They Useful in the Diagnosis of Intraocular Tumors?

These newer imaging modalities may be useful for detecting predictive factors in some cases.

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Clinical assessment of medium to large choroidal melanomas is generally carried out using biomicroscopy, fundus photography, and ultrasonography. Whereas diagnosis and management of small choroidal melanomas remains controversial, new imaging techniques, such as optical coherence tomography (OCT) and fundus autofluorescence, are useful to detect subretinal fluid and lipofuscin, which are considered factors predictive of growth of small pigmented choroidal lesions.¹

OCT OF PIGMENTED CHOROIDAL LESIONS

Since the introduction of OCT into clinical practice more than 10 years ago, many efforts have been made to assess the potential role of this imaging technique in the diagnosis of

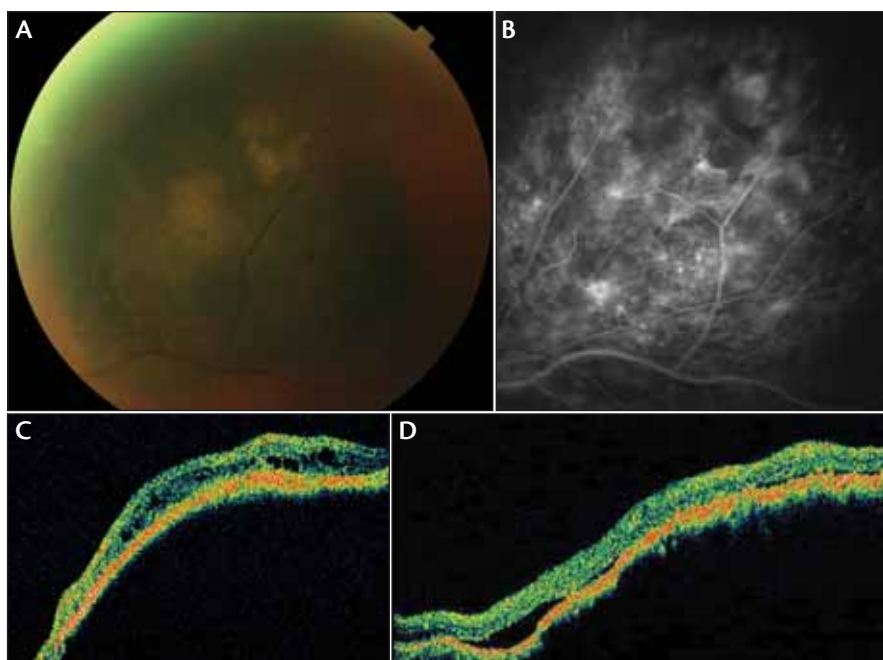


Figure 1. Pigmented choroidal melanoma with a mixed OCT pattern. A pigmented choroidal melanoma at the midperiphery with orange pigment (A). Fluorescein angiography shows a pattern of hyperfluorescent hot spots with leakage (B). Linear OCT scan detects chronic retinal and RPE changes over the tumor (intraretinal cysts and focal thickening of the RPE) (C). Linear OCT scan detects a retinal detachment around the tumor margins (D).

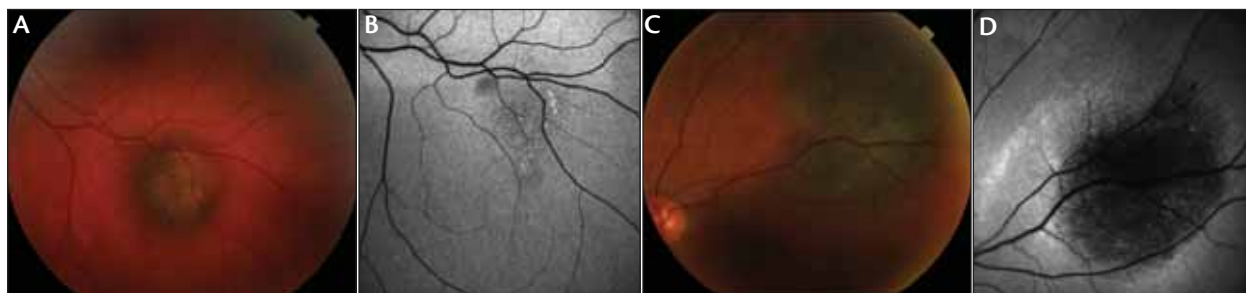


Figure 2. Fundus autofluorescent patterns in small pigmented choroidal lesions. Color fundus image of a choroidal nevus (A). Fundus autofluorescent image shows a patchy AF pattern with small distinct areas of increased autofluorescence (B). Color fundus image of a choroidal melanoma (C). Fundus autofluorescent image shows a diffuse AF pattern with indistinct borders of increased autofluorescence (D).

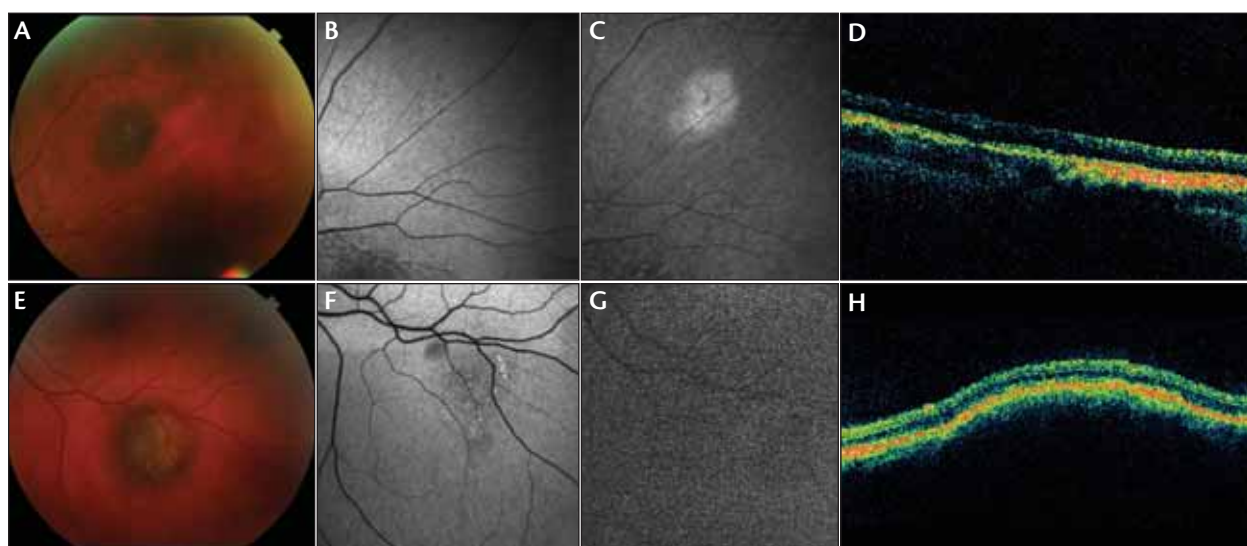


Figure 3. Fundus near-infrared (NIR-AF) patterns of choroidal nevi. Color fundus image of a small choroidal nevus (A). Standard fundus autofluorescent image (SW-AF) shows a normal background autofluorescence (B). NIR-AF shows a uniform bright hyperautofluorescent area (C). Linear OCT scan detects a flat nevus (D). Color fundus image of a choroidal nevus (E). Standard fundus autofluorescent image (SW-AF) shows a patchy AF pattern with small distinct areas of increased autofluorescence (F). NIR-AF image detects a normal background autofluorescence (G). Linear OCT scan shows an elevated nevus (H).

pigmented choroidal tumors. In 1998, Schaudig et al² concluded that because the OCT beam is strongly scattered by the retinal pigment epithelium, reflections from within the tumor mass are weak. Therefore, OCT is not useful for in vivo histologic typing of choroidal tumors. This technique can document retinal changes in tissues surrounding and overlying choroidal tumors. Retinal edema, retinal thinning, drusen, retinal pigment epithelial detachment, and subretinal fluid are detectable using OCT in choroidal tumors.^{3,4} In particular, OCT may detect retinal detachment around tumor margins undetected by ultrasonography or biomicroscopy.^{2,5} (Figure 1)

Unfortunately, subretinal fluid is not a pathognomonic feature of choroidal melanoma: it has also been observed in 26% of choroidal nevi.⁴ Moreover, there is

no agreement whether subretinal fluid is strictly correlated to tumor growth.

Recently, several OCT patterns have been described and correlated with the risk of tumor growth. Espinoza et al⁵ distinguished an active OCT pattern, indicating the presence of localized serous retinal detachment; a chronic one, characterized by retinal and retinal pigment epithelium (RPE) atrophic changes or intraretinal cysts; and a negative OCT pattern with no retinal changes. The active OCT pattern was associated with leakage on fluorescein angiography and documented growth at follow-up in 50% of cases, whereas 11% of cases with a chronic OCT pattern grew during follow-up. Again, many pigmented choroidal tumors show a mixed OCT pattern, with cystoid retinal changes allo-

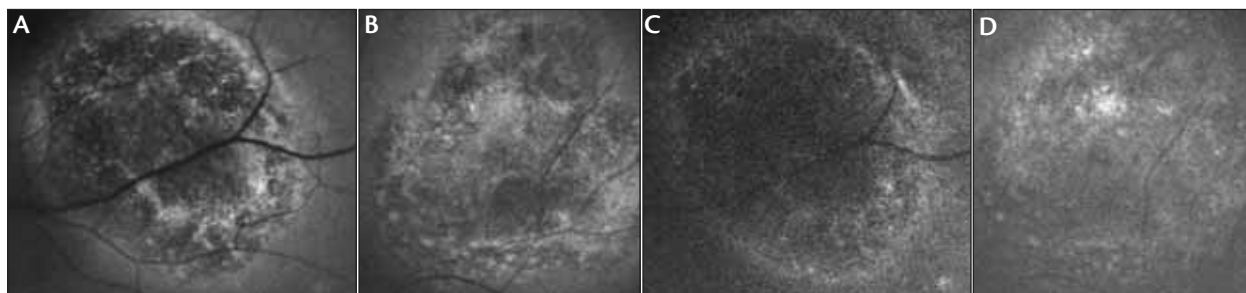


Figure 4. Standard fundus autofluorescence (SW-AF) and near-infrared fundus autofluorescence (NIR-AF) of choroidal melanomas. SW-AF pictures of two choroidal melanomas (A, B) and NIR-AF (C, D) do not show significant differences with hypo- and hyperautofluorescent areas using both wavelengths.

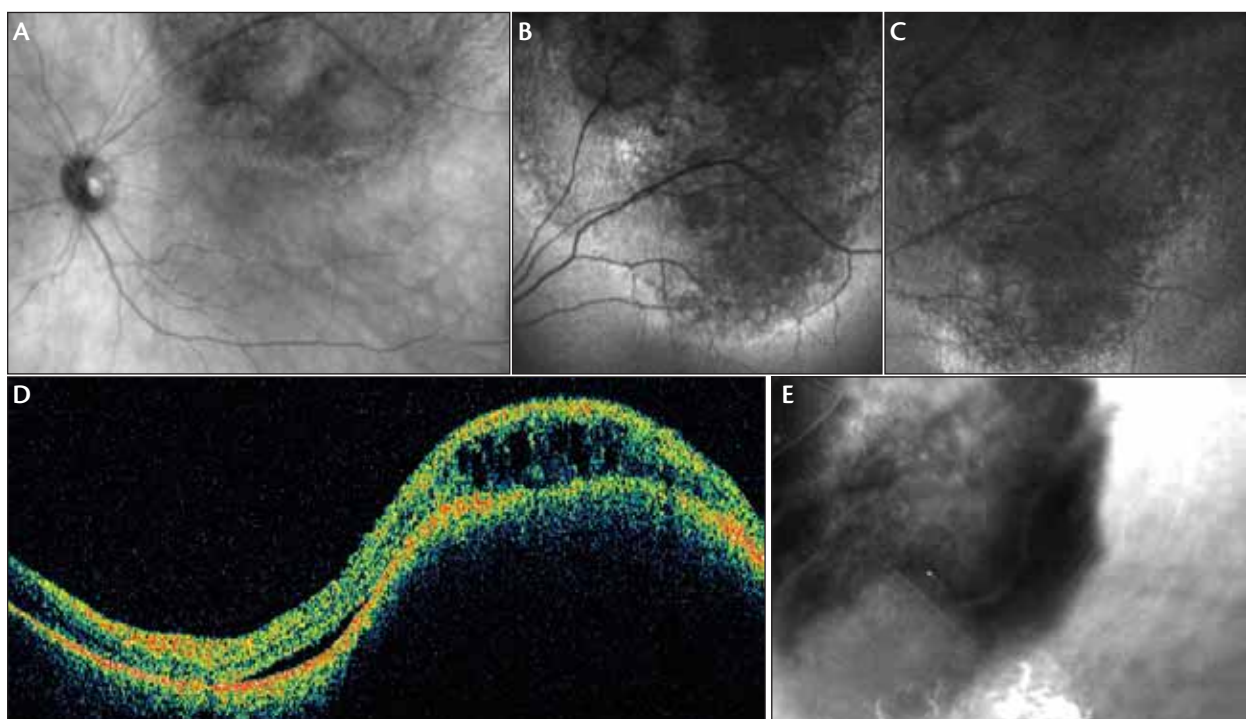


Figure 5. Different imaging techniques of a case of choroidal melanoma. Infrared confocal image of a recurrence of a choroidal melanoma previously treated with I-125 brachytherapy (A). Standard and near-infrared images show a hyperautofluorescent halo around the tumor margins (B,C). OCT linear scan detects active and chronic retinal and RPE changes over and around the tumor (D). A retromode image obtained with a confocal SLO (F-10, Nidek) detects the area of the recurrence at the posterior pole (E).

cated over the lesion and retinal detachment around tumor margins (Figure 1).

Fourier-domain OCT is a novel imaging technique that allows us to obtain retinal images faster and with higher resolution than with time-domain OCT. This imaging technique, which is now widely used in clinical practice offers detailed information especially of individual retinal layers and the RPE. It is possible that in the near future, Fourier-domain OCT may help us to detect new findings useful in the diagnosis of small pigmented undetermined choroidal lesions.

FUNDUS AUTOFLUORESCENCE

Choroidal melanomas are characterized by hyperplasia, atrophy, fibrous and osseous metaplasia, and intracellular lipofuscin accumulation. Lipofuscin accumulates into the RPE cells and in macrophages of malignant choroidal tumors. Using clinical biomicroscopy, it is usually seen as orange pigment over the lesion. Lipofuscin accumulation can be examined by standard fundus autofluorescence using short-wavelength light (SW-AF). Fundus autofluorescence is useful in depicting the metabolic status of RPE. Different SW-AF patterns have been

described in choroidal melanocytic lesions. Gündüz and coworkers⁶ analyzed the fundus autofluorescence characteristics of pigmented choroidal lesions using confocal scanning laser ophthalmoscopy. Excitation is made with argon blue wavelength (488 nm), and capture uses wavelength above 500 nm. A patchy and a diffuse SW-AF pattern were identified. The patchy AF pattern was defined as the presence of distinct areas of increased AF between areas of normal AF, while the diffuse one was defined by the presence of increased AF with indistinct borders over a majority (>50%) of the tumor without intervening areas. It has been shown that a diffuse AF pattern was more frequent among melanomas than among nevi, which were more frequently characterized by a patchy AF pattern.⁶

The use of different imaging techniques may contribute in the diagnosis of small pigmented choroidal lesions.

It has been suggested that longer and deeper wavelengths, as near infrared (NIR), could provide more information about choroidal pigmented lesions. With NIR fundus autofluorescence (NIR-AF) imaging, we can explore the melanin distribution, as oxidized melanin, or compounds closely associated with melanin, contributes substantially to NIR-AF.⁷

We recently investigated standard AF and NIR-AF in small pigmented choroidal tumors, and we correlated different pattern of AF with OCT findings and analyzed the role of these diagnostic techniques in the diagnosis of intraocular tumors. AF imaging was performed using a confocal system (Heidelberg Retinal Angiograph, HRA 2; Heidelberg Engineering, Heidelberg, Germany). AF images were recorded at 488 nm wavelength using a barrier filter for the detection of emitted light above 500 nm (standard AF or SW-AF). The NIR-AF images were recorded at 780 nm with a barrier filter at 820 nm. OCT linear scans over the lesions and around the margins were obtained using the time domain Stratus OCT (Carl Zeiss Meditec, Jena, Germany).

At SW-AF, choroidal nevi showed a normal pattern of background AF with no corresponding areas of hyperfluorescence or hypoautofluorescence over the nevi in 50% of the cases (Figure 2). In the remaining 50% of cases, the lesion showed mild hypoautofluorescence (in 25%) or hyperautofluorescent (in 25%), with faint localized hyperautofluorescent small areas in all cases (Figure 3). Nevi with normal background fundus fluorescence

were flat, while nevi with a different pattern of fundus fluorescence were elevated with drusen or lipofuscin. Using NIR-AF, flat nevi appeared as bright hyperautofluorescent areas. Elevated nevi with mild hyperautofluorescence or hypoautofluorescence in standard AF were hypoautofluorescent in NIR-AF (Figure 4).

At NIR-AF, choroidal melanomas showed hypo- and hyperautofluorescent areas in all cases with hyperautofluorescent halo in 62%, due to retinal detachments around tumor margins. The hyperautofluorescent areas at NIR-AF corresponded to the pigmented areas of the tumor. Comparing SW-AF and NIR-AF images of choroidal melanomas, we were unable to detect significant differences (Figure 5). Lipofuscin has a broad excitation spectrum but also a broad emission one, so it can be detected using different wavelengths.

SUMMARY

In conclusion, standard autofluorescence with SW-AF and fundus autofluorescence with near-infrared NIR-AF provide information on different intrinsic pigments of pigmented choroidal lesions and on related RPE and retinal changes, but other pigments such as porphyrin may play a role in AF imaging of choroidal tumors, mainly if they contain products of hemoglobin degradation. The use of different imaging techniques may contribute in the diagnosis of small pigmented choroidal lesions. ■

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