Optical coherence tomography in diagnosing, differentiating and monitoring of choroidal nevi – 1 year observational study

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Abstract

OBJECTIVE: To assess the utility of the optical coherence tomography (OCT) in diagnosing, differentiating and monitoring of choroidal nevi situated in the posterior pole and optic disc area.

MATERIAL AND METHOD: 116 consecutive patients (65 women, 51 men) aged 27–95 years, with choroidal nevus were included to the research. Routine ophthalmoscopic evaluation and OCT using the Zeiss Stratus OCT as well as fundus photography were performed in each patient. The OCT was used to assess the structure of the retina overlying the choroidal nevus, the retinal pigment epithelium (RPE) – choriocapillaris complex, as well as the anterior portion of the choroidal lesion. In 31 patients due to suspected malignant melanoma fluorescein angiography and ultrasound were additionally performed. Follow-up OCT was done after 12 months in 51 out of 85 patients with characteristics of choroidal nevi, and after 6 and 12 months in 27 patients with "suspicious" lesion.

RESULTS: The basal dimension of the lesion ranged from 0.5 mm to 12 mm (mean 2.75mm), mean thickness was 1.25 mm. The pigmented lesion did not affect visual acuity. In 85 patients the lesion was flat or slightly elevated, without secondary changes in the retina. In 31 patients additional changes in the retina were observed – most frequently subretinal fluid. Two patients were eventually diagnosed with malignant melanoma. The follow-up OCT did not show progression in neither patients without secondary changes nor those with risk factors of malignancy.

CONCLUSION: Optical coherence tomography enables detailed evaluation of the retina overlying the pigmented lesion. Secondary changes in the retina need additional exams and strict observation. OCT could be an additional tool in the evaluation of treatment of malignant melanoma.

ORIGINAL ARTICLE

INTRODUCTION

Choroidal nevi occur in approximately 6–10% of Caucasian population and are usually benign. They require close observation due to possible malignant transformation. Differentiation between choroidal nevi and small malignant melanomas could be especially difficult because of their similar clinical presentation (Shields *et al.* 1995, Singh *et al.* 2005). Shields *et al.* based on their observations distinguished five risk factors of malignant melanoma and created a mnemonic TFSOM ("To Find Small Ocular Melanoma") where T (Thickness) stands for tumour thickness > 2 mm, F (subretinal Fluid) – presence of subretinal fluid, S (Symptoms) – clinical symptoms (flashes, floaters), O (Orange pigment) – presence of lipofuscin deposits and M (Margin touching optic disc) – margin touching or less than 3 mm from optic disc (Shields *et al.* 2002, Shields *et al.* 2004). In 2009 three new risk factors were identified: UH – ultrasound hollowness, H – absence of surrounding halo, D – absence of drusen, which created the new mnemonic TFSOMUHHD (To Find Small Ocular Melanoma Using Helpful Hints Daily) (Shields *et al.* 2009). Usually none of these risk factors are present in choroidal nevi, on the other hand tumours displaying 2 or more factors have an over 50% risk of transformation into melanoma at 5 years. The presence of the following factors: TSM shows an especially poor prognosis and increases the risk to 69% (Shields *et al.* 2009). Amelanotic nevi need to be differentiated from choroidal metastasis, granuloma, osteoma, or sclerochoroidal calcification (Shields *et al.* 2008).

Pigmented lesion diagnosis is based on slitlamp, angiographic and ultrasound examination, with the use of Doppler technique where necessary. These methods cannot determine the histological type of the tumour which is necessary to establish the appropriate treatment and prognosis. The introduction of optical coherent tomography to the field of diagnostics of retinal diseases and the possibility of histological evaluation of retina *in vivo* raised hopes that similar evaluation could be possible for the choroid. Despite much research however and advances in the OCT equipment the low penetration of the light beam to the choroid makes imaging thereof difficult and histological evaluation *in vivo* of choroidal tumours remains still in the field of research.

Fig. 1. Pigmented choroidal naevus – clinical photograph.

PURPOSE

To determine the utility of optical coherence tomography in diagnosing and differentiating of pigmented choroidal lesions as well as in their regular monitoring.

MATERIAL AND METHOD

116 consecutive patients (65 women, 51 men), aged 27–95 years, with pigmented choroidal lesion situated in the posterior pole or near the optic disc were included in the study. Routine ophthalmoscopic examination and OCT using the Zeiss Stratus OCT as well as fundus photography were performed in each patient. The lesions were discovered upon routine examination, they were clinically silent.

The OCT images were obtained using 3–8 mm linear scans. The following structures were analysed: structure of the retina overlying the lesion, the RPE – choriocapillaris complex as well as the accessible anterior portion of the lesion. In those cases where the basal dimension of the lesion was over 7 mm or its thickness over 2 mm the OCT evaluation was difficult. The scans obtained went either through the edge or apex of the lesion. Further exams (angiography and ultrasound) were performed in 31 patients where malignant melanoma was suspected.

Follow up OCT was done after 12 months in patients with features of benign lesion (51 patients), and after 6 and 12 months in patients with "suspicious" lesion (27 patients).

RESULTS

In the examined group the basal dimension of the choroidal lesion ranged from 0.5 mm to approximately 10–12 mm (mean 2.75 mm), mean thickness was 1.25 mm. The presence of the lesion did not affect visual acuity. In 58% of cases the lesions were located near the macula, in 30% near the optic disc, and in 12% near the upper or lower vessels (Figure 1). In 57% of cases the lesions had a hyporeflective surface (Figure 2), in 34% – the surface was hyperreflective, in 9% isoreflective – indistinguishable from surrounding tissue. In 66 patients (57%) the thickness and structure of retina overlying pigmented lesion was unaffected, these were flat or slightly elevated (<1 mm) nevi. In 13 patients (11%) the OCT revealed chronic changes in in the form of drusen in pigmented epithelium (Figure 3). Secondary changes in the retina overlying the lesion

were observed in 31 patients (27%), they were: photoreceptor disruption (1.7%) (Figure 4), subretinal fluid (8%) (Figure 5), retinal edema (4%), retinoschisis (0.8%), retinal pigment epithelium detachment (0.8%) (Figure 6), lipofuscin exudates (1.7%).

The lesion was elevated > 1 mm in 16 patients (14%).

Further exams – angiography and ultrasound – were performed in the group of 31 patients with secondary changes, due to suspicion of malignant melanoma. Final diagnosis of malignant lesion was made in 2 cases with tumour elevation > 2 mm and serous retinal detachement, in 1st case the lesion was located above the optic disc, in 2nd case it surrounded the optic disc.

In follow up OCT there was no progression observed in neither groups – that without secondary changes nor that with risk factors – even in those cases where subretinal fluid was present.

DISCUSSION

Optical coherence tomography is not a routinely used tool in diagnosing pigmented choroidal lesions. This could be due to its technical limitations such as low light beam penetration and unsatisfactory visualisation. Reflectivity of the choroid does not change significantly in case of nevi nor tumours. The optical coherence tomography therefore does not help evaluate the structure of pigmented lesion nor draw conclusion about its histology, and as it is known the treatment and prognosis is based on the histological type of tumour (Schaudig *et al.* 1998, Rospond-Kubiak *et al.* 2006). The OCT however can precisely evaluate the structure of the retina overlying the lesion, the RPE – choriocapillaris complex, and the accessible anterior portion of the nevus.

The optical coherence tomography is important in determining the reason for deterioration of visual acuity in case of pigmented lesions located in the macula. The most common pathology is the presence of lipofuscin deposits on the surface, RPE detachement and macular oedema (Shields *et al.* 2007). In the examined group the location of the lesions was extra-foveal which did not affect visual acuity.

The morphology of the retina overlying the lesion plays an important diagnostic role and enables differentiation with malignant melanoma, especially a small one (Espinoza *et al.* 2004, Muscat *et al.* 2001, Muscat *et al.* 2004, Shields *et al.* 2005a,b).

The result of OCT image analysis are similar to those described by Shields on the group of 120 patients. The most frequently reported changes were the thickening of the retinal pigment epithelium and choriocapillary layer, with characteristic shadowing of the deeper layers, which depends on the amount of accumulated pigment as well as vascularization of the choroid. The reported features were seen in benign nevi as well as most of those lesions which due to their location or size could be suspected of malignancy. According to Shields, disruptions in the fotoreceptor layer, retinal

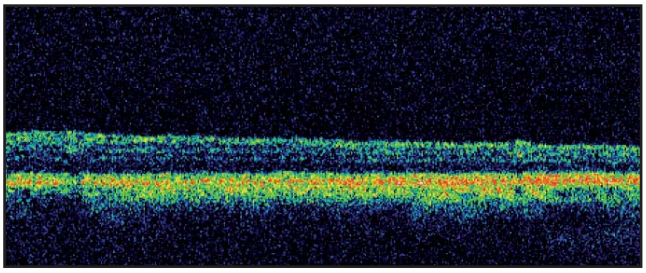

Fig. 2. OCT of choroidal naevus – shows thickening and hyperreflectivity of the RPE/choriocapillaris layer and hyporeflectivity of the underlying choroid.

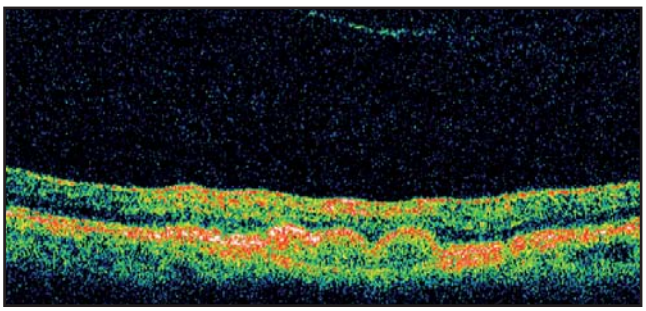

Fig. 3. OCT of chronic choroidal naevus with drusen.

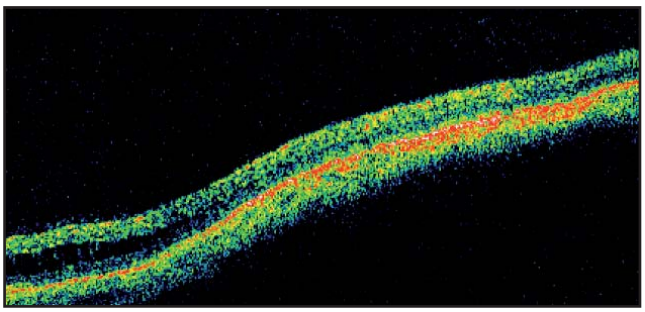

Fig. 4. OCT of an elevated choroidal naevus – shows thinning and disorganization of the retina at the apex – loss of the photoreceptor layer and intra – retinal splitting at the base.

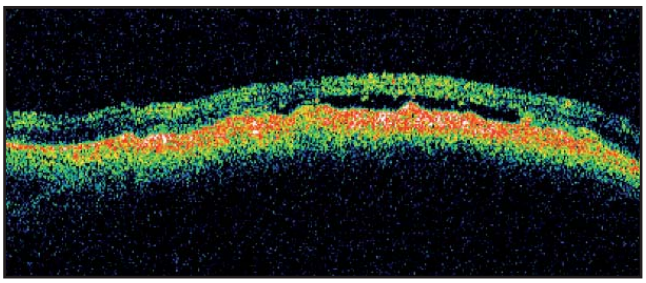

Fig. 5. OCT of an elevated naevus with shallow subretinal fluid at the apex, thinning and disorganization of the retina.

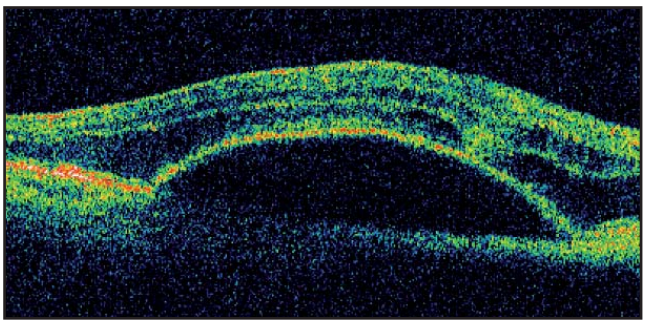

Fig. 6. OCT of choroidal naevus with RPE detachment and retinal edema.

thinning or intraretinal edema are characteristic for chronic nevi. Subretinal neovascularization on the surface of the nevus is a rare complication and it is believed to be an indicator of benign nature of the lesion (Zografos *et al.* 2004). The presence of fresh subretinal fluid with undisrupted fotoreceptor layer however could be a sign of a malignant tumour. Malignant melanomas of the choroid could lead to disorganisation of retinal layers and/or presence of optical shadowing associated with tumour calcification. According to Espinoza serous retinal detachment is an important risk factor for malignant transformation of pigmented lesion. It plays an important role in diagnostics and monitoring.

Small amounts of subretinal fluid or minimal retinal edema could be undetected in clinical or angiographic exam. Optical coherence tomography plays and important role in detection of these pathologies (Espinoza *et al.* 2004, Muscat *et al.* 2004, Shields *et al.* 2005a). Precise differentiation between benign nevi and small melanomas is not completely possible, and even in those lesions where risk factors are present there is only a 50 % chance for malignant transformation (Singh *et al.* 2006). These lesions should be under the strict control – there are early treatment trials which aim to stabilise the tumour or improve visual acuity if the lesion affects the fovea. When should we decide to start treatment? In the examined group the follow-up OCT exam did not show progression of secondary changes in the retina nor did it show tumour growth. On the other hand it is vital to monitor – with the use of OCT – those patients treated for malignant melanoma (Muscat *et al.* 2001, Soucek & Cihelkova 2004). Duquesne *et al.* observed spontaneous regression of fluid in 25% of patients with pigmented nevi accompanied by presence of subretinal fluid, in the rest of cases they applied treatment with corticosteroids, transpupillary thermotherapy or gas injection, obtaining regression of lesions (Duquesne *et al.* 2002). Our observations based on OCT exam show regression of subretinal fluid in 2 patients treated with thermotherapy due to malignant melanoma.

CONCLUSION

Optical coherence tomography enables detailed evaluation of the retina overlying the pigmented lesion. Secondary changes in the retina overlying the choroidal nevus need further diagnostic exams and strict observation of the lesion. Optical coherent tomography could be useful in frequent monitoring of patients with pigmented choroidal lesions, especially in detecting and observation of subretinal fluid – an important risk factor of malignant transformation. OCT could be an accessory method in evaluating the effects of treatment of malignant melanomas.

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