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ORIGINAL ARTICLE

Optical coherence tomography in the evaluation of macular retinoblastoma

Tomografia de coerência óptica na avaliação do retinoblastoma macular

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ABSTRACT

The retinoblastomais known as the most common intraocular malignancy of the childhood. In addition to other diagnostic methods theOptical Coherence Tomography (OCT) may be considered an important tool in the evaluation ofselective involvement of the retinaby small and medium sized tumors at the posterior pole of the eye.The authors present two cases of retinoblastoma in which the OCT was ableto demonstrate the morphological features of the tumor at diagnosis and the structural changes in tumor tissue and in adjacent retina that occurred, in each case, after different modalities of treatment.

Keywords:Retinoblastoma/diagnosis; Retinal neoplasms/diagnosis, Tomography, opticalcoherence; Case reports

RESUMO

O retinoblastomaé conhecido como o mais comum dos tumores intra-oculares na infância. Além dos métodos convencionais de diagnóstico, podemos acrescentar a Tomografia de Coerência Óptica (OCT) como um instrumento relevante na avaliação seletiva do comprometimento retiniano, dos tumores pequenos e médios do pólo posterior.Os autores apresentam 2 casos de retinoblastoma nos quais a OCT pode demonstrar as características morfológicas do tumor ao diagnóstico e as modificações estruturais do tecido tumoral e da retina adjacente, que ocorreram, em cada caso, após distintas modalidades de tratamento.

Descritores:Retinoblastoma/diagnóstico; Neoplasias da retina/diagnóstico;Tomografia de coerência óptica; Relatos de casos

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Introduction

Optical Coherence Tomography (OCT) may be an important diagnostic tool in the non-invasive assessment of the intraocular retinoblastoma, before, during and after treatment.

The technique of Optical Coherence Tomography (OCT) developed in the 90s has been used to analyze the microstructure of the biological tissues by measuring their optical reflections[1]. The OCT system uses low optical coherence interferometry (Diode Light 830 nm) to produce images that define the different layers that make up the tissues like a histological section, in real time and with a resolution of up 3µm[2].

The purpose of this report is to present the usefulness of Optical Coherence Tomography in patients with retinoblastoma located in the macular area, demonstrating the morphological characteristics of the tumor and the adjacent retina, as well as the tissue changes observed throughout the follow-up period.

Case 1

V.M.P.A., male, 15 months of age with a family history (mother) of bilateral retinoblastoma.

The initial ophthalmologic examination under general anesthesia did not reveal any abnormalities in both eyes. Two months later, a single lesion was identified in the right eye, located in the macula and measuring approximately 1/6 of the optic disc diameter (stage I - Reese-Ellsworth (R-E) classification / stage "A" of Murphree classification). At that time, the ocular ultrasonography showed a small lump of approximately 1 mm in the macular area, which did not allow further characterization of the lesion due to their small thickness (Figures 1 and 2). The left eye showed no abnormality.

The Optical Coherence Tomography scan showed the presence of a nodular, isodense, well-defined intraretinal lesion excluding the possibility of foveal depression. It could also be seen a structural disorganization of neurosensory retina in the place, with apparent preservation of the photoreceptor layer and the underlying pigment epithelium. A blurring of the deep retinal layers may be seen as an artefact, possibly due to intralesional calcium (Figure 3).

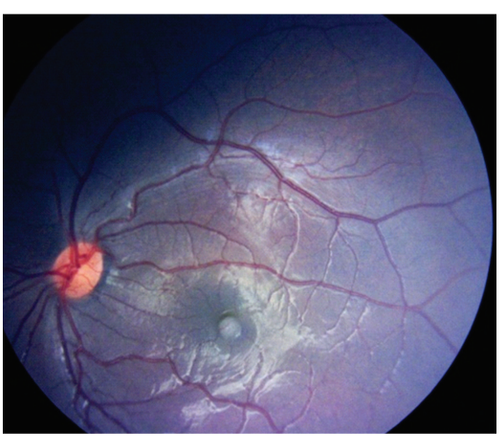

Figure 1: Retinography (RetCam) of the tumor at diagnosis

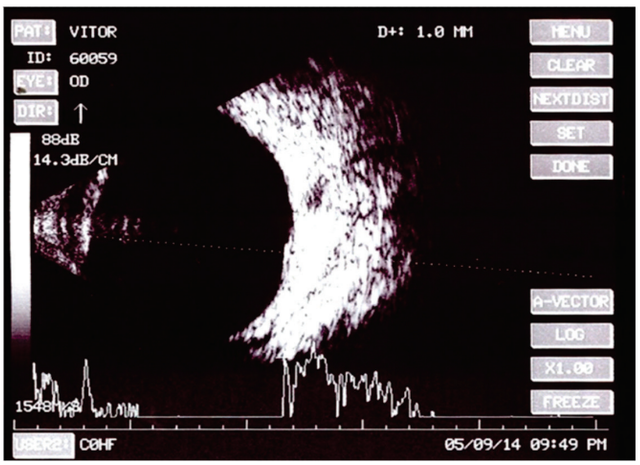

Figure 2: Ultrasound mode A/B showing little lump corresponding to the retinoblastoma in the right eye

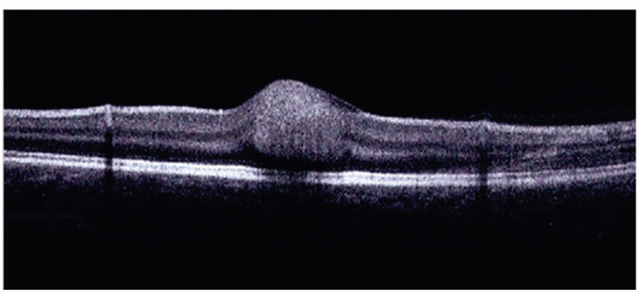

Figure 3: Optical coherence tomography made at the diagnosis demonstrates the tumor substituting the intermediate layers of the retina

The treatment in this case was the Transpupillary Thermotherapy - laser Diode 810nm (TTT).About 5 weeks after laser therapy, the Optical Coherence Tomography was repeated and showed some disorganization of the tumor tissue associated to a mild flattening of the lesion and partial recovery of the fovea surface. (Figures 4 and 5).

The visual acuity assessment of this patient can not be deemed reliable to date due to its age.

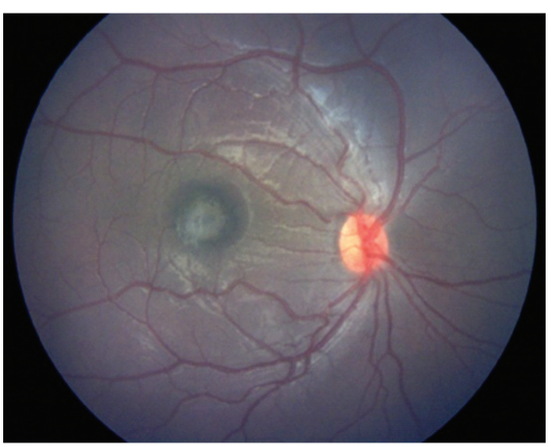

Figure 4: Angiography (RetCam) showing changes in the clinical appearance of the tumor in the macula of the right eye 5 weeks after the initial laser therapy.

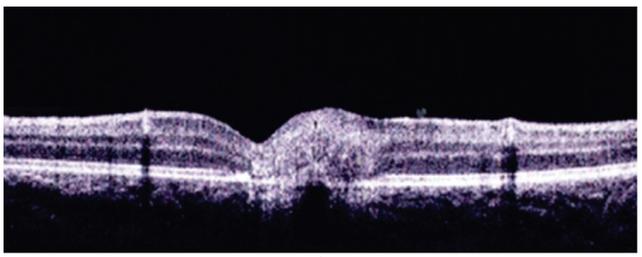

Figure 5: OCT showing the tumor morphological changes observed 5 weeks after the initial laser therapy.

Case 2

L.W.X., 7 years old, female, with a family history (mother) of bilateral retinoblastoma.

On an exam when she was 2 months and 25 days old she was diagnosed with retinoblastoma in both eyes. At the time, the child showed in the right eye: a single, flat, temporal to fovea lesion measuring approximately 1/8 of the optic disc (stage R-E: I / Murphree: A). In the left eye, multiple lesions were identified in the posterior pole, most of them measuring about 7 mm and involving the macula (stage R-E: II / Murphree B).

The patient was treated with systemic chemotherapy associated to local therapy for the left eye lesions (Transpupillary thermotherapy - Laser Diode 810nm and Brachytherapy-Iodine^{125}).

The only tumor focus on the right eye did not receive complementary focal treatment due to its small size, its macular location and overall stability of the lesion during and after chemotherapy. These aspects were determinant of the expectant conduct adopted after the completion of chemotherapy.

The right eye macular injury underwent changes in its color over time, becoming virtually invisible both to indirect ophthalmoscopy and digital angiography in the last years of follow-up. However, the Optical Coherence Tomography was able to reveal the intra-retinal lesion in the macular area and demonstrate their inactivity characteristics seven years after chemotherapy (Figure 6).

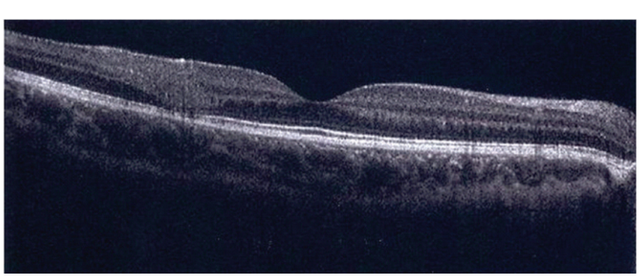

Figure 6: Optical coherence tomography revealing the intra-retinal lesion in the macula of the right eye 7 years after chemotherapy.

The visual acuity was 20/20 in the right eye and 20/100 in the left eye at the last ophthalmologic assessment.

The left eye had it OCT evaluation impaired at this occasion due to certain opacity of the posterior capsule of the crystalline.

The clinical retinal images of both patients were obtained using the systems RetCam™ (RetCam™ Shuttle - Clarity Medical Systems, CA, USA) and Optical Coherence Tomography - Spectral Domain (Optovue Inc., Freemont, CA, USA).

Discussion

The technology of Optical Coherence Tomography has radically changed the diagnostic imaging in Ophthalmology as well as in other specialties since its introduction in 1991[1-9].

The main characteristic of this exam is the exceptional definition ability of the tissues and their morphological changes, which has contributed to increase the knowledge about many pathologies, in particular those involving the central retina and the optic nerve papilla[2,3].

The high resolution of the images obtained in seconds and without direct contact with the eye are some of the advantages of the method. Its high sensitivity allows an early diagnosis even of the most difficult retinal lesions to be detected by ophthalmoscopy and/or digital angiography. However, despite the excellence when it comes to high resolution imaging, its application in eye oncology is still limited in our environment, not only due to the high cost of portable equipment which is more suitable to assess pediatric patients, but also due to its application be still restricted to small and medium tumors located in the posterior pole of the globe[10].

Recently, some authors have defined standards that distinguish the active tumors from scar lesions by the particular morphological characteristics of each condition, demonstrated by the Optical Coherence Tomography[11].

Recent publications on the use of OCT in the assessment of intraocular retinoblastoma have shown that the exam can be crucial in conducting numerous situations, assisting in treatment planning, controlling the response of tumors to the treatment and after its completion, identifying possible early tumor recurrences[2,11].

The early detection capacity of the optic nerve invasion by retinoblastoma exceeds the diagnostic sensitivity of other imaging exams such as MRI and eye ultrasound, as already reported in literature[3].

In the first case of this report, the Optical Coherence Tomography played an important role in tumor identification, in demonstrating its growth, in the time slot that preceded the treatment and, above all, in demonstrating the structural changes displayed by the tumor after the onset of focal therapy by Transpupillary thermotherapy. The test continues to be performed until the end of treatment, i.e., until the observation cicatricial changes, characteristics of tumor destruction, and control after completion of therapy for early identification of possible recurrences or new tumors.

Regarding the second patient, the exam was essential in identifying the tumor located in the right eye macula, which had undergone changes in its color throughout the follow-up period, becoming virtually invisible both to the indirect ophthalmoscopy and the digital angiography. The Optical Coherence Tomography, however, was able to detect the intra-retinal lesion and characterize it as a flat lesion, and not nodular anymore, with inaccurate lateral boundaries, restricted to the neurosensory retina, with apparent preservation of the photoreceptor layer and the retinal pigment epithelium seven years after chemotherapy (Figure 6).

Conclusion

Despite the Indirect Binocular Ophthalmoscopy remains

the main exam for the diagnosis of intraocular tumors of the posterior segment, the Optical Coherence Tomography emerges as a valuable complementary tool, in that it adds information about tissue structure important for the treatment planning and monitoring of small tumors of the posterior pole of the eyeball.

In the cases presented here, the Optical Coherence Tomography was able to reveal an intra-retinal lesion not detected by indirect ophthalmoscopy and other exams, and helped demonstrating the tumor growth and its response to treatment, thereby contributing to enlarge our knowledge about retinoblastoma and its behavior.

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