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Secondary Glaucoma in Intraocular Tumors in Adults

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Summary: The most common malignant intraocular tumors in adults include uveal melanoma, intraocular metastatic tumors, leukemic infiltrates, and intraocular lymphoma.
Elevated intraocular pressure occurs in approximately 5% of eyes with intraocular tumors. Glaucoma may develop secondary to intraocular tumors in adults through various mechanisms such as drainage angle infiltration, angle closure, or neovascularization. These tumors may be primary (e.g., uveal melanoma) or metastatic. Unilateral or treatment-resistant glaucoma should prompt suspicion of an intraocular tumor. The type and location of an intraocular tumor determine the likelihood of elevated intraocular pressure.
Based on literature data and our own cases, the paper reviews the mechanisms of secondary glaucoma development in the most common intraocular tumors in adults.

Key words: secondary glaucoma, intraocular tumors, radiation complications.

Introduction

The most common malignant intraocular tumors in adults include uveal melanoma, intraocular metastatic tumors, and intraocular lymphoma.

The incidence of elevated intraocular pressure in eyes with intraocular tumors is approximately 5% [1]. The type and location of an intraocular tumor determine the likelihood of elevated intraocular pressure. All intraocular tumors may contribute to disturbances in intraocular pressure and the development of secondary glaucoma. The pathogenesis of this condition may involve various factors such as the location of tumors in the anterior segment of the eye (tumors involving the drainage angle hinder the outflow of aqueous humor), the large size of the intraocular tumor, inflammatory reactions associated with tumor necrosis and breakdown, as well as neovascularization resulting from radiation-induced vascular changes in the eye and hypoxia.

Recommended diagnostic examinations

The patient should undergo a biomicroscopic examination of both the anterior and posterior segments of each eye, along with a detailed gonioscopic assessment of the drainage angle. All patients should undergo a comprehensive dilated fundus examination (provided that the drainage angle of the anterior chamber is not closed) [2]. During the examination, attention should be paid to characteristic features suggesting the presence of an intraocular tumor.

Several possible alterations in the anterior segment of the eye should be carefully evaluated, including dispersion of melanin in the anterior chamber or at the drainage angle; dilated episcleral blood vessels; anterior segment inflammation or blood in the anterior chamber; heterochromia of the iris; neovascularization of the iris or drainage angle; closed or narrow angle; tumor masses in the iris, ciliary body, or in the drainage angle region; and absence of the red reflex (with shadows suggesting tumor masses that are clearly visible during transillumination); during the examination of the posterior segment of the eye: retinal detachment, tumor masses in the posterior segment (typically at the posterior pole), vitritis, and vitreous hemorrhage.

In instances of opaque ocular media, such as cataract, hemorrhage, or other causes, an ultrasonographic examination is indicated, while suspected ciliary body tumors or tumors of the peripheral iris regions warrant an ultrasound biomicroscopy (UBM) examination.

Uveal melanoma, a primary intraocular tumor, is a life-threatening malignancy with a high (approximately 50%) risk of distant metastasis. It can develop in the iris, ciliary body, or choroid. Atypical manifestations of posterior uveal melanoma include vitreous hemorrhage, retinal detachment, retinal pigment epithelium detachment, cystoid macular edema, choroidal detachment, uveitis, and secondary glaucoma [1–6]. Uveal melanoma may mimic various forms of secondary glaucoma, which occurs in only about 3% of cases. The elevation of intraocular pressure caused by uveal melanoma may result from angle-closure glaucoma, direct infiltration of the drainage angle by a ring melanoma of the iris and/ or ciliary body, neovascular glaucoma, dissemination of tumor cells or phagocytosed melanin particles into the anterior chamber angle in melanomalytic glaucoma, or from inflammatory processes [5–11].

Ring melanoma, a rare subtype of uveal melanoma, may manifest as circumferential tumor growth involving the iris, ciliary body, and/ or choroid. Its characteristic feature is the high frequency of secondary glaucoma due to infiltration of the drainage angle and obstruction of aqueous humor outflow. Because the tumor can be difficult to detect, misdiagnosis may occur – for example, as pigmentary glaucoma. In cases of unilateral glaucoma, diagnostic evaluation should be extended to include UBM. Glaucoma surgery should be deferred until melanoma has been ruled out as the underlying cause. In patients with cataract, when intraocular structures cannot be adequately assessed, an ultrasound examination is recommended before scheduled surgery (Fig. 1, 2).

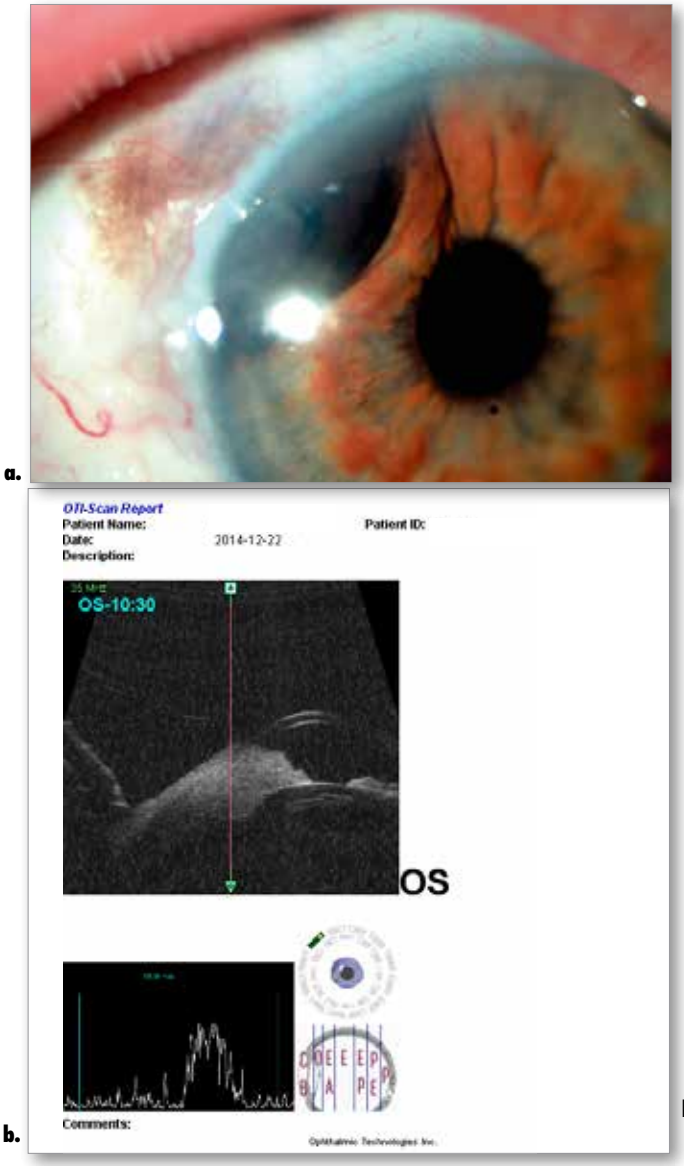


Fig. 1. Ciliary body melanoma displacing the lens and iris – a. photograph, b. UBM, c. ciliary body melanoma displacing artifitial lens.

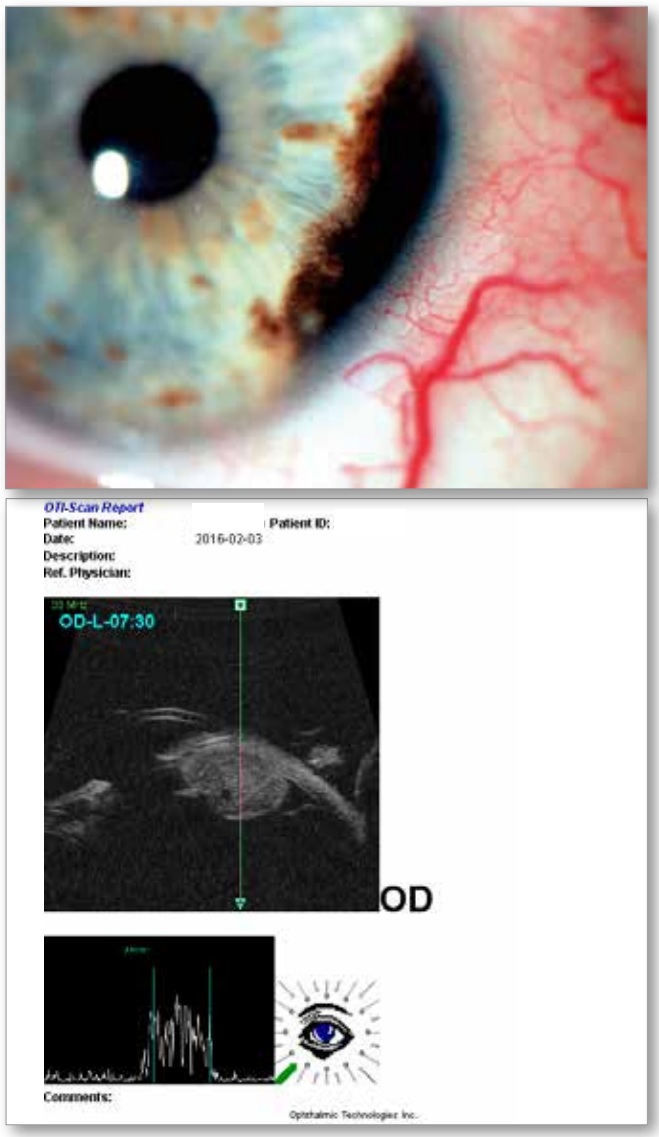


Fig. 2. Ring melanoma – a. photograph, b. UBM.

Local effects of tumor growth may lead to secondary glaucoma of various pathogeneses: infiltration of the drainage angle and hemorrhage into the anterior chamber may impair aqueous humor outflow through the trabecular meshwork. Tumor necrosis and hemorrhage impede aqueous humor outflow (by blocking the drainage angle) through melanomalytic cells and red blood cells, or may cause congestion of the ciliary body with anterior displacement of the iris–lens diaphragm, leading to an acute attack of angle-closure glaucoma [12–15]. A large ciliary body tumor mass located behind the iris pushes it forward and closes the angle.

The presence of choroidal melanoma may cause exudative retinal detachment and hemorrhage. In rapidly growing tumors, necrosis may also occur. Prolonged exudative retinal detachment associated with the tumor, coupled with ischemia, can lead to neovascular glaucoma.

Glaucoma is recognized as an independent prognostic factor for poor outcomes in uveal melanoma, which is most often linked to late detection and inadequate therapeutic intervention. Uveal melanoma is rare; however, before proceeding with filtration surgery or any intraocular procedure, it is essential to clinically exclude an intraocular tumor through detailed diagnostic evaluation, due to the increased risk of metastasis associated with this potentially fatal disease.

Intraocular metastases

The most common type of intraocular tumors are metastases originating from distant cancers, typically spreading via the bloodstream and lymphatic system, or, less frequently, through

direct invasion from adjacent tissues. Tumor cells reach the uveal tract through hematogenous spread and usually form multiple metastatic foci, primarily in the posterior pole of the eye. The most common primary malignancies are breast cancer, lung cancer, and kidney cancer [2]. Aside from leukemia and lymphoma, carcinomas metastasize to the eye far more frequently than sarcomas [11]. Approximately 90% of ocular metastases develop in the posterior segment of the eye, often presenting as multiple and occasionally bilateral lesions. Patients typically present with visual deterioration and, occasionally, ocular pain. On examination, retinal detachment over the tumor mass is observed, with anterior segment tumors appearing less frequently. Symptoms of uveitis and secondary glaucoma may also occur (Fig. 3, 4) [4].

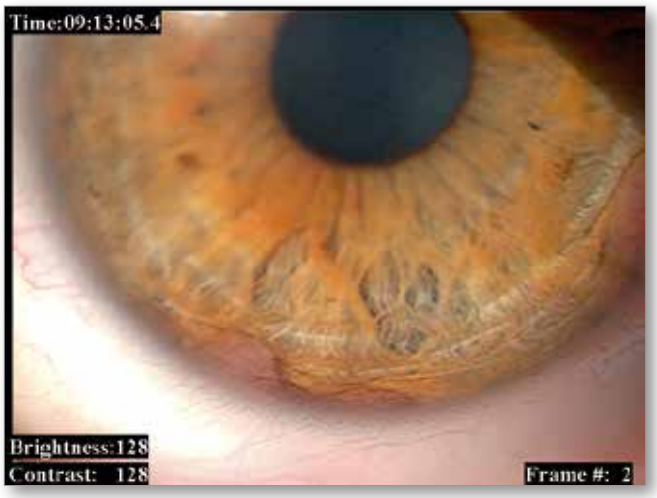


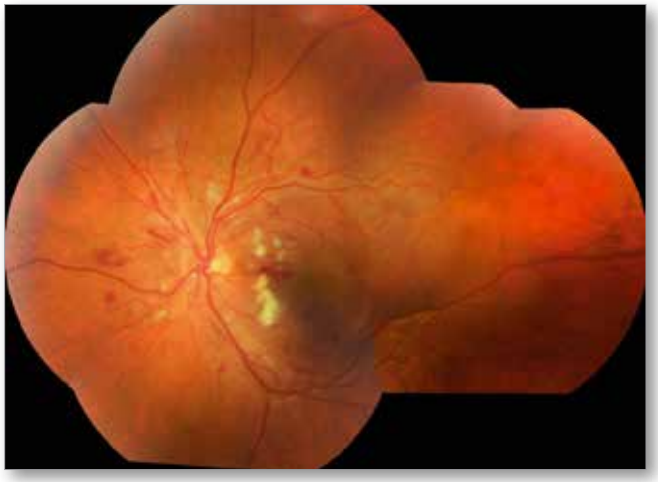
Fig. 3. Breast cancer metastases in the iris.

Fig. 4. Choroidal metastases from breast cancer (posterior pole of the eye).

In patients with metastases or uveal melanoma, elevated intraocular pressure is more frequently observed in tumors involving the anterior segment of the uveal tract, including the ciliary body and iris. In cases of iris metastases, secondary glaucoma may occur in up to one-third of patients [16, 17].

Leukemias

In approximately one-third of cases of systemic leukemia, leukemic infiltrates may occur in the eye [11]. The most common causes of secondary glaucoma in patients with leukemia are acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML).



Ryc. 5. Naciek w naczyniówce chłoniaka wewnątrzgałkowego.
Fig. 5. Leukemic cells infiltration.

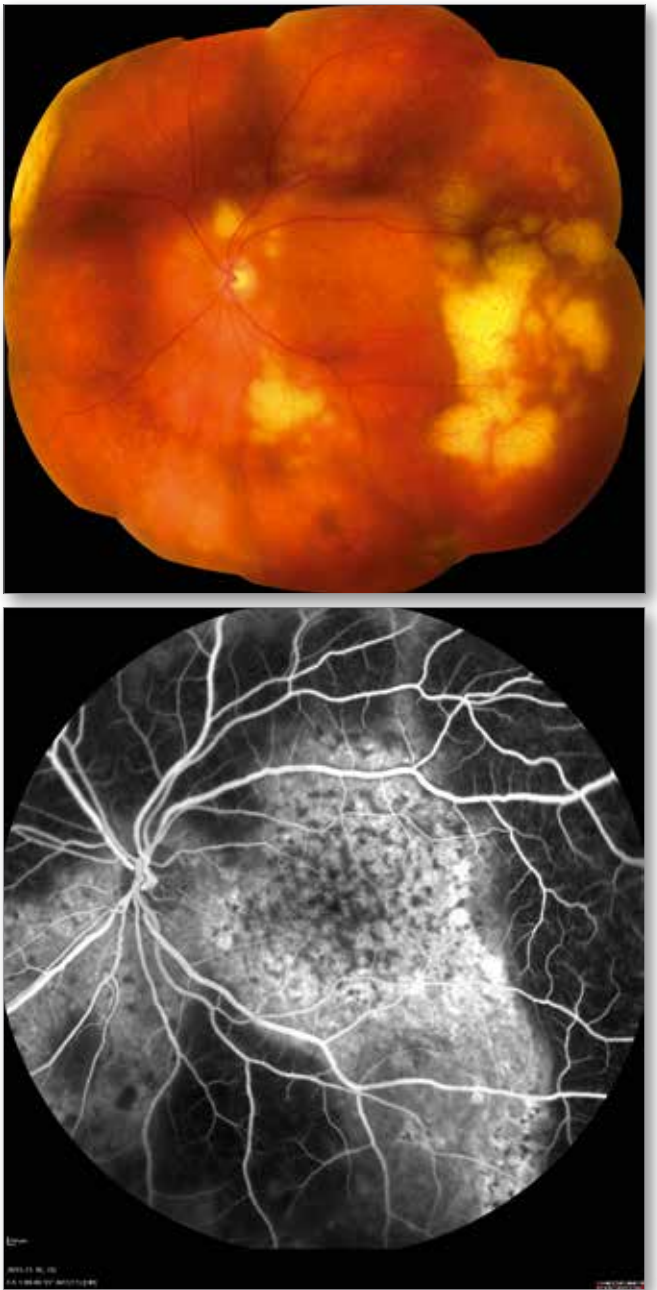


Fig. 6a., b. Choroidal lymphoma.

Secondary glaucoma is usually caused by mechanical blockage of the anterior chamber angle by leukemic cells [18]. During examination, a pseudohypopyon may be observed in the anterior chamber due to the layered arrangement of leukemic cells [18]. Secondary angle-closure glaucoma can also occur.

Intraocular lymphoma

Central nervous system non-Hodgkin's lymphomas (CNS--NHLs) more frequently involve the eye than non-CNS lymphomas [19]. CNS-NHLs typically affect the retina and vitreous body, with patients usually reporting vitreous floaters (Fig. 5) [19]. On examination of the anterior segment, signs of inflammation may be present, including keratic precipitates, hyphema, corneal edema, and/ or pseudohypopyon (accumulation of tumor cells). On posterior segment examination, vitreitis and subretinal infiltrates may be found [20]. Intraocular lymphomas not associated with the CNS often metastasize via the choroidal circulation to the uvea (Fig. 6). Clinical manifestations usually include ocular pain and redness, and blurred vision [20].

Secondary elevation of intraocular pressure most commonly occurs due to tumor dissemination in the trabecular meshwork, but cases of angle-closure and neovascularization of the iris have also been reported.

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