

Scleral Necrosis Following Plaque Radiotherapy of Uveal Melanoma

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Plaque radiotherapy is the most common conservative treatment for uveal melanoma. This therapy has been custom-adapted for melanoma at all sites within the eye, including choroid and ciliary body melanoma as well as juxtapapillary and iris melanoma. Plaque radiotherapy is effective for control of uveal melanoma of small, medium, or large size, each receiving similar apex dose of 7200 cGy with adjusted radiation rate per hour, delivered generally over a period of 5 to 7 days. According to the Collaborative Ocular Melanoma Study, 12-year patient survival following plaque radiotherapy was equivalent to enucleation.¹

Ocular complications of plaque radiotherapy are generally the result of ischemic side effects to local tissue, related to the location of plaque radiotherapy as well as the relative dose. Complications include radiation-induced dry eye, diplopia, strabismus, iris neovascularization, neovascular glaucoma, cataract, retinopathy, maculopathy, optic neuropathy, vitreous hemorrhage, and scleral necrosis.² In an analysis of 5057 patients with uveal melanoma managed with plaque radiotherapy, Kaliki et al² found scleral necrosis in 73 cases (1%). Herein, we document a case of iridociliochoroidal melanoma treated with plaque radiotherapy with subsequent scleral necrosis.

CASE REPORT

A 66-year-old white female noted photopsia in the left eye (OS) for 8 months. Upon examination, best corrected visual acuity (BCVA) was 20/25 in the right eye (OD) and 20/80 OS. The right eye was unremarkable. In the left eye, episcleral sentinel vessels were numerous inferiorly. There

was a pigmented iris mass inferiorly with localized iris stromal seeding. Posteriorly, this mass continued into the inferior quadrant of the ciliary body and choroid, measuring 18 mm in total basal diameter (Figure 1). Subretinal fluid was noted. Ocular ultrasonography disclosed a dome-shaped acoustically hollow mass 10.5 mm in thickness. A diagnosis of iridociliochoroidal melanoma was rendered. Due to the extramacular tumor location and relatively preserved central vision, plaque radiotherapy was provided using a 22-mm round I-125 plaque, with apex dose of 7200 cGy achieved over 124 hours.

At 4-month follow-up, the patient noted difficulty with accommodation OS, likely related to incipient cataract. At 17 months follow-up, BCVA was 20/30 OD and 20/40 OS. Scleral thinning of 9 mm basal diameter was noted inferiorly, and location correlated to the central portion of the radioactive plaque. At 28 months follow-up, the entire region of scleral thinning (necrosis) was stable at 9 mm in diameter, but there was a darker central area of 3 mm in diameter demonstrating conjunctival invasion. Hydroxypropyl methylcellulose gel (Gentel, Alcon) was prescribed for lubrication. At 36 months follow-up, BCVA was 20/20 OD and 20/400 OS secondary to cataract. The tumor had regressed to a scar 14 mm in base and 4.4 mm in thickness. The scleral necrosis was stable without perforation (Figure 1).

DISCUSSION

Plaque radiotherapy is an effective treatment for small, medium, and large melanoma. With regard to large melanoma, plaque radiotherapy allows globe salvage in

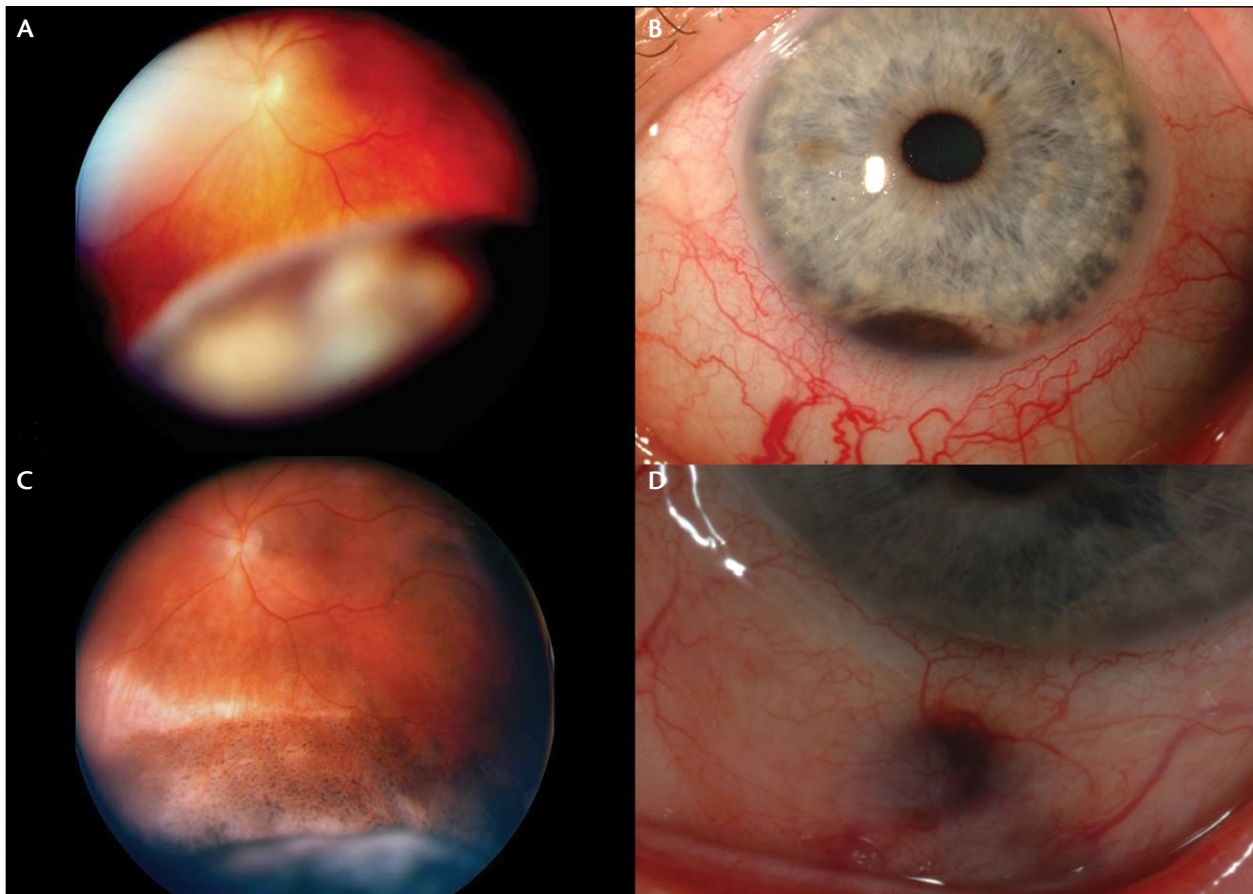


Figure 1. Plaque radiotherapy for iridociliochoroidal melanoma showing tumor regression and the development of scleral necrosis. At presentation, wide-angle image of left fundus showing ciliochoroidal component of the melanoma. The entire tumor measured 18 mm in basal diameter and 10.5 mm in thickness (A). At presentation, the iris portion was evident inferiorly, and prominent episcleral sentinel vessels were noted (B). At 19 months following plaque radiotherapy, the melanoma demonstrated regression to a scar of 14 mm in basal diameter and 6.3 mm in thickness (C). At 43 months following plaque radiotherapy, the iris component showed complete regression, but scleral thinning covered by Tenon fascia and conjunctiva was evident (D). There was no perforation or hypotony.

most cases with potential for partial visual retention.³ Thicker tumors require a more intense dose rate to reach the tumor apex, thus exposing the globe to greater complications. The sclera is relatively resilient to damage from radiotherapy.³ Scleral thinning can occur following radiotherapy of uveal melanoma. This can occur as a direct result from the high doses of radiotherapy leading to tissue melting, or it can result from an inflammatory response within the necrotic tumor that releases cytotoxic elements in the surrounding area and results in localized tissue damage.⁴ We believe that both mechanisms could have led to the necrosis in our case. In a study of 354 patients with large posterior uveal melanomas (>8 mm thickness), scleral necrosis was detected in 7% of cases at 5 years and 9% at 10 years.³

Kaliki et al² studied the topic of scleral necrosis follow-

ing plaque radiotherapy. In a comparison of eyes with scleral necrosis versus eyes with no scleral necrosis, they noted several important findings, including a relationship of scleral necrosis occurrence in eyes with greater mean tumor thickness (8 mm in eyes with necrosis vs 6 mm in those without necrosis), larger mean tumor base (13 mm vs 11 mm), and greater radiation dose to the tumor base (360 Gy vs 313 Gy). Of those eyes with scleral necrosis, ciliary body location of the anterior tumor margin was more common (71%) compared with those without scleral necrosis where tumor location was more posterior (63%).²

In our case, scleral necrosis was first identified 17 months postoperatively. Kaliki et al² noted that patients who developed scleral necrosis following plaque radiotherapy showed evidence of necrosis by 1 year in 30%, by 2 years in 55%, by 5 years in 85%, and by 10 years in 97%.

The management of scleral necrosis depends on many factors but generally relies on the risk for impending perforation. Most eyes do not perforate, and globe integrity is maintained. Occasionally, a scleral patch graft to ensure globe integrity is placed. Precautions to avoid ocular rubbing or direct trauma to the eye are advised. Lubrication of the ocular surface is prescribed to maintain intact conjunctiva and Tenon fascia. Protective polycarbonate glasses and goggles are suggested. If complete perforation is found, then enucleation is considered.² Radin and associates reported that the mean diameter of scleral necrosis at detection was 4.4 mm in their cohort of 23 patients with scleral necrosis following radiation therapy for uveal melanoma.⁴ In that series, scleral necrosis remained stable in 74% of patients, increased in severity in 9%, and decreased in severity in 13%.

In summary, scleral necrosis is an uncommon finding following plaque radiotherapy for uveal melanoma. Most patients do well without the need for patch graft. This finding generally occurs centrally at the site of plaque placement and is detected by 5 years after treatment in most cases. ■

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1. Collaborative Ocular Melanoma Study Group. The COMS randomized trial of iodine 125 brachytherapy for choroidal melanoma. V. Twelve-Year Mortality Rates and Prognostic Factors: COMS Report No. 28 *Arch Ophthalmol*. 2006;124:1684-9163.

2. Kaliki S, Shields CL, Rojanaporn D, et al. Scleral necrosis after plaque radiotherapy of uveal melanoma: a case-control study. *Ophthalmology*. 2013;120:1004-1011.

3. Shields CL, Naseripour M, Cater J, et al. Plaque radiotherapy for large posterior uveal melanomas ($\geq$ 8-mm thick) in 354 consecutive patients. *Ophthalmology*. 2002;109:1838-1849.

4. Radin PP, Lumbruso-Le Rouic L, Levy-Gabriel C, et al. Scleral necrosis after radiation therapy for uveal melanoma: report of 23 cases. *Graefes Arch Clin Exp Ophthalmol*. 2008;246:1731-1736.