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Case Report

Clinical Experience of Stereotactic Radiosurgery at a Linear Accelerator for Intraocular Melanoma Combined with Iridociliary Tumor Resection: A Case Report

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Keywords
Uveal melanoma · Iridociliary melanoma case report · Stereotactic irradiation · Block excision · Intraocular tumor

Abstract
Introduction: The treatment of iridociliary and choroidal melanoma relies on the patient's systemic health, tumor size, location, related features, state of the opposing eye, and personal preferences. The two categories are radiation and surgical techniques. Transpupillary thermotherapy, plaque radiotherapy, charged particle irradiation, local resection, enucleation, orbital exenteration, and experimental nanoparticle therapy are all options for treating choroidal melanoma. ***Case Presentation:*** The method that entails creating a partial thickness circular, rectangular, or polyhedral scleral flap in the region covering the tumor after removing a portion of the extraocular muscles is the most popular method for local excision in choroidal or choroidal-ciliary body cancers. We discuss our experience treating iridociliary melanoma using block excision and stereotactic irradiation on a linear accelerator with TD 20.0 Gy. ***Conclusion:*** One of the treatment modalities is the combined treatment approach using stereotactic irradiation and tumor resection, and our results 1 year after therapy are comparable to the rates of local control and anatomic eye preservation to those achieved in studies of comparable uveal melanoma treatment modalities.

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Introduction

Skin, uvea, and mucous membranes can all be affected by the deadly cancer melanoma. Due to inadequate sun protection practices among both at-risk individuals and melanoma patients, the incidence of melanoma has grown over the past few decades [1]. The most frequent primary intraocular malignant tumor in adult Caucasians is intraocular uveal melanoma (UM) [2, 3]. UM has a mean age-adjusted incidence of 5.1 per million [4]. According to the Surveillance, Epidemiology and End Results (SEER) database of the National Cancer Institute, UM was more common in men (4.9 per million) than in women (3.7 per million) at all ages, and the mean age at presentation was 60 years [4].

Shields and coworkers found that UM mostly affected the choroid (90%), ciliary body (6%), or iris (4%) in their examination of 8,033 UM patients from a single tertiary referral hospital over a four-decade period [5]. Symptoms of choroidal melanoma typically include photopsia (flashes), floaters, visual field loss, or loss of visual acuity, or they may not present at all [6]. Sentinel vessels might be seen if the ciliary body is affected by the tumor. Rarely, pain from secondary glaucoma, tumor-related inflammation, or necrosis can result from melanoma [7].

Based on thickness, choroidal melanoma is divided into three categories: small (0–3 mm), medium (3–8 mm), and big (>8 mm). The average basal dimension and thickness of choroidal melanoma are 11.3 mm and 5.5 mm, respectively. It typically manifests as a dome (75% of the time), mushroom (20%), or diffuse (5% of the time). When the tumor herniates into the subretinal space and ruptures through Bruch's membrane, it takes on the shape of a mushroom and appears bilobed [8].

Due to the accessibility of the iris and ciliary body, surgical excision is frequently utilized to treat minor malignancies. As a result of the technical difficulty of the surgery and the possibility of extrascleral or systemic diffusion, surgical excision of choroidal malignancies is significantly more difficult and is only carried out at specialized facilities. There are now two different surgical methods used. The first is transscleral resection (ab externo procedure), which is also referred to as "exoresection" and can also be referred to as iridectomy, cyclectomy, or choroidectomy (or any combination of these), depending on where the tumor is located (in the iris, ciliary body, or choroid). Endoresection (ab interno procedure) is the name of the second surgical technique. The best therapeutic strategy is still debatable because both methods have benefits and drawbacks, especially when treating big UMs [9, 10].

Stereotactic irradiation 1-day surgery is one of the used techniques, the results due to prognosis are similar to other irradiation techniques, and the therapeutic dose is 35.0 Gy or in tumors in iridociliary localization 20.0 Gy with a comparable chance of survival to brachytherapy, proton beam irradiation, or enucleation [11]. Transscleral resection is a difficult and debatable surgery. It is typically carried out while the patient is experiencing severe controlled systemic hypotension, which is a risky procedure. This procedure, known as partial lamellar sclerouvectomy, enables the excision of the tumor while keeping the outer sclera and retina intact. It is a challenging surgical treatment that is best carried out by a skilled ophthalmologist [10, 12].

The first instance of local excision of UM was reported in 1,911 in a female patient, age 25, who also had ciliary body melanoma. The term "choroidectomy" was used by Stallard in the 1960s to describe a method for removing choroidal or ciliary body melanomas through a scleral lamellar flap while also resecting the sclera. However, because of the severe treatment-related side effects – vitreous loss, major hemorrhage, retinal detachment, and tumor cell propagation to the orbit – this method never attained widespread popularity.

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Case Description

In March 2022, the 78-year-old man was seen with a complaint of a "brown spot on his right eye that was enlarging in size." Examination revealed a darkly pigmented, anterior chamber tumor present in the superior nasal quadrant of the iris with neovascularization in the right eye (Fig. 1 left). Slit lamp biomicroscopy and gonioscopy revealed that the tumor had infiltrated the anterior chamber angle. Ultrasound biomicroscopy demonstrated the connection with the ciliary body. MRI demonstrated the iris area of the right eye tumor mass by size approx. 6 × 3 mm, dorsally pressing on the lens and laterally on the ciliary muscles (Fig. 1, right), without clinical signs of extrabulbar growth. Visual acuity of the right eye was 9,25-2,50 50° 20/50 ETDRS, left eye −5,75-0,75 14° 20/20 ETDRS, IOP right eye 11 Torr, left eye 13 Torr. The patient was in good general health status, and there was no metastasis found on PET CT overall. We decided with the oncologist and radiation oncologist and the patient's agreement to perform stereotactic radiosurgery on a linear accelerator followed by en bloc tumor removal with iridocyclectomy.

Radiosurgical procedure means surgical preparation and fixation of all the rectus muscles before radiosurgical procedure itself. On the day of irradiation, a stereotactic frame was fitted onto the patient. The patient with a fitted stereotactic frame underwent CT and MRI examination, by means of which the tumor is precisely measured. The size of the calculated volume of the tumor was 0.2 cm^3. There then follows the planning of the distribution of the dose of radiation in such a manner that the tumor is blasted with a dose of 20.0 Gy, and the surrounding structures receive as little as possible. This consists of the application of photon beams from an external source into the tumor to receive the highest dose of radiation in the volume of the tumor and the lowest dose in the surrounding tissues. After the fusion of an individual irradiation plan, the patient was irradiated with a single dose of 20.0 Gy on the 6-MV photon-linear accelerator (Fig. 2, 3).

After stereotactic irradiation, circular laser coagulation of the peripheral retina was performed to prevent subsequent potential retinal complications, resulting from potential retinal irradiation complications and degeneration. Four weeks after, we continued to perform en bloc tumor removal with iridocyclectomy, iridoplasty, partial sclerectomy, and cryotherapy of the peripheral retina under general anesthesia. Microscopic examination revealed pieces of tissue including the sclera, ciliary body, and iris. Histopathological examination found the iris tissue with malignant melanoma G2, spindle cell type B. Immunophenotype described was S100+, melanA+, HMB45+ 50%, Bcl2+, p53-, cyklinD1 450%, AIF+1, CD117+ 50% Ki67+-<5%. One year after surgery, his vision remained largely stable. Visual acuity of the right eye is −8 D 20/63 ETDRS with cataract progression, IOP 7 mm Hg (Fig. 4). Both gonioscopy and high-frequency ultrasound showed no evidence of tumor recurrence. The patient was followed at an outside clinic, where reports indicate no metastasis in the lung and liver, so his overall physical and psychological condition remained largely stable.

Discussion

Incomplete tumor excision and seeding brought on by the manipulation of the eye globe during surgery are two possible causes of local recurrence, particularly the spread of tumor cells that is aided by the distribution of subretinal fluid in the surgical region. The recurrence typically appears along the margin, but in rare instances, it cannot be contiguous with the underlying tumor, necessitating more rigorous therapy. In between 6% and 13.9% of cases, a residual tumor is reported [13].

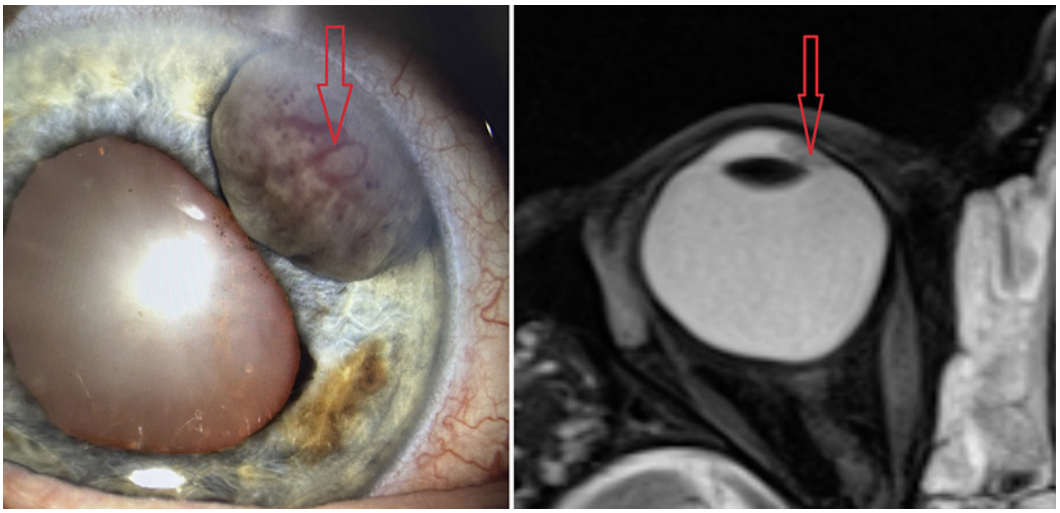

Fig. 1. Left: clinical status before stereotactic irradiation and block excision surgery – the anterior segment of the eye (red arrow – the tumor). Right: MRI finding of the eye with the tumor on the anterior segment before stereotactic surgery (red arrow – the tumor).

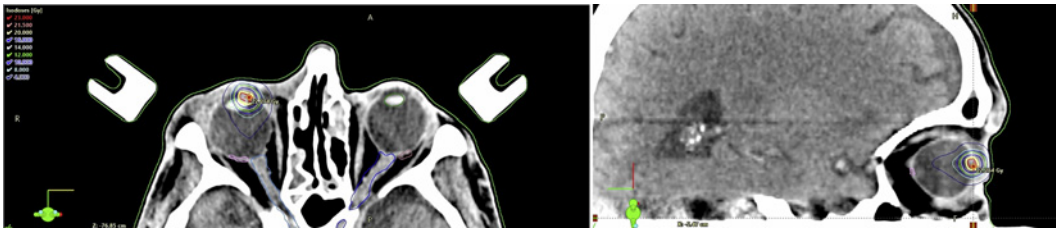

Fig. 2. Left: stereotactic irradiation scheme by LINAC 1-day surgery; TD was 20.0 Gy in the tumor (red color). Right: stereotactic irradiation scheme by LINAC 1-day surgery – sagittal view; TD was 20.0 Gy in the tumor, TD max 22.0 Gy (red color).

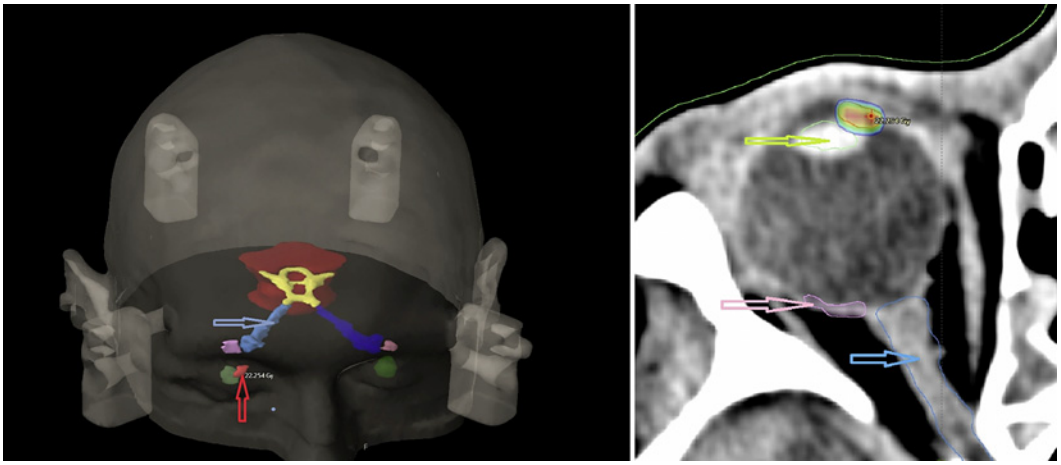

Fig. 3. Left: visualization and 3D view of the individual stereotactic irradiation scheme by LINAC 1-day surgery (red arrow – the tumor, blue arrow – the optic nerve). Right: individual stereotactic irradiation scheme by LINAC 1-day surgery (blue arrow – the optic nerve, pink arrow – the macula, green arrow – the lens).

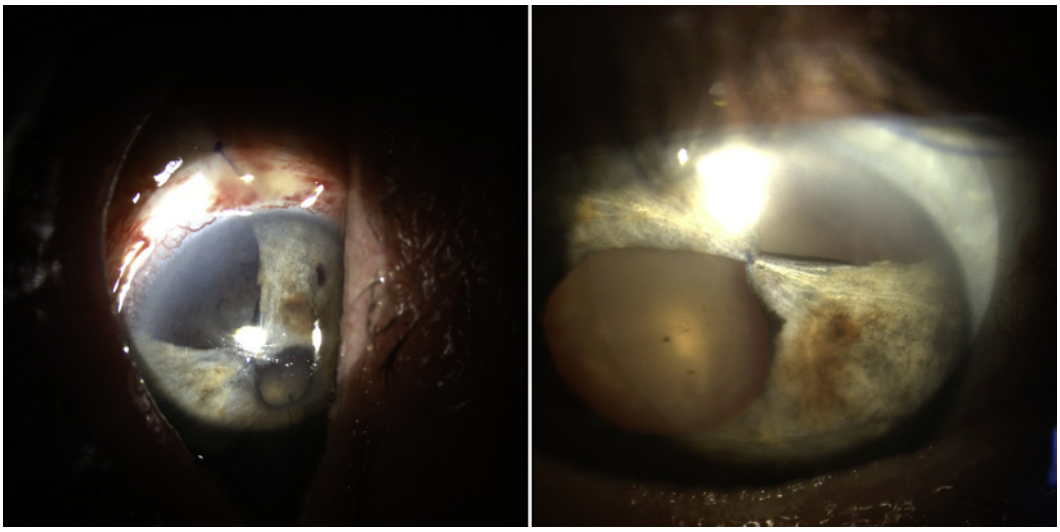

Fig. 4. Left: clinical status after stereotactic irradiation and block excision surgery – the anterior segment of the eye. Right: clinical status 6 months after stereotactic irradiation and block excision surgery – the anterior segment of the eye.

In the study of Suesskind et al. [14], the local tumor control at 3-year interval was 85% for single-dose stereotactic irradiation monotherapy and 100% for combined therapy. They reported in 6 patients the recurrences within the first 3 years (mean, 21 months). In other studies of stereotactic radiotherapy, local tumor control between 96% and 100% was achieved [15].

It is important to evaluate the tumor parameters before the treatment, and better results were achieved when the tumors were much smaller than those in the study of Suesskind [14]. Due to our experience in the patient 1 year after combined treatment, there was no metastatic spread nor local recurrence. The CARE Checklist has been completed by the authors for this case report, attached as supplementary material (for all online suppl. material, see https://doi.org/10.1159/000535129).

Conclusion

The combined treatment approach using stereotactic irradiation and tumor resection is one of the treatment modalities, and our observation 1 year after therapy is comparable to the rates of local control and anatomic eye globe preservation to those achieved in studies of comparable treatment modalities for UM.

Acknowledgments

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Statement of Ethics

This case report adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images. Ethical approval is from Institutional Ethics Committee of University Hospital in Bratislava, Slovakia (protocol code EC/074/2023 from June 12, 2023).

Conflict of Interest Statement

Authors have no financial or proprietary interest in any material or method mentioned.

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Author Contributions

The authors' contributions to the work in terms of its theoretical and/or practical value: conception and design of the study – J.V. and A.F.; acquisition of data – A.F., M.C., J.G., and M.S.; analysis and/or interpretation of data – J.V., A.F., and I.P.; drafting the manuscript – A.F. and R.F.; revising the manuscript critically for important intellectual content – A.F., R.F., P.V., I.P., and D.L. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

All data related to this case report are included in the article. Further inquiries must be directed to the corresponding author.

References

1 Mueller AM, Goessinger EV, Cerminara SE, Kostner L, Amaral M, Huber SM, et al. Educational level-dependent melanoma awareness in a high-risk population in Switzerland. Front Oncol. 2023;13:1174542.
2 Kivelä TT, Piperno-Neumann S, Desjardins L, Schmittel A, Bechrakis N, Midena E, et al. Validation of a prognostic staging for metastatic uveal melanoma: a collaborative study of the European ophthalmic oncology group. Am J Ophthalmol. 2016;168:217–26.
3 Jouhi S, Jager MJ, de Geus SJR, Desjardins L, Eide NA, Grange J-D, et al. The small fatal choroidal melanoma study. A survey by the European ophthalmic oncology group. Am J Ophthalmol. 2019;202:100–8.
4 Singh AD, Turell ME, Topham AK. Uveal melanoma: trends in incidence, treatment, and survival. Ophthalmology. 2011;118(9):1881–5.
5 Shields CL, Kaliki S, Furuta M, Fulco E, Alarcon C, Shields JA. American Joint Committee on Cancer classification of posterior uveal melanoma (tumor size category) predicts prognosis in 7,731 patients. Ophthalmology. 2013;120(10):2066–71.
6 Hawkins BS. Collaborative ocular melanoma study randomized trial of I-125 brachytherapy. Clin Trials. 2011;8(5):661–73.
7 Manchegowda P, Singh AD, Shields C, Kaliki S, Shah P, Gopal L, et al. Uveal melanoma in asians: a review. Ocul Oncol Pathol. 2021;7(3):159–67.
8 Shields CL, Kaliki S, Livesey M, Walker B, Garoon R, Bucci M, et al. Association of ocular and oculodermal melanocytosis with the rate of uveal melanoma metastasis: analysis of 7,872 consecutive eyes. JAMA Ophthalmol. 2013;131(8):993–1003.
9 Shields CL, Mashayekhi A, Shields JA. By sleight of hand, prognosis determined-even for small choroidal melanoma. JAMA Ophthalmol. 2018;136(5):488–9.
10 Jager MJ, Shields CL, Cebulla CM, Abdel-Rahman MH, Grossniklaus HE, Stern M-H, et al. Uveal melanoma. Nat Rev Dis Primers. 2020;6(1):24.

11 Sramka M, Furdova A, Chorvath M, Sepesi B, Kralik G, Furda R. Our experience with stereotactic radiosurgery operations for intraocular melanoma. Ruzomberok: Onkologia; 2018. p. 13–4.
12 Damato B. Ocular treatment of choroidal melanoma in relation to the prevention of metastatic death: a personal view. Prog Retin Eye Res. 2018;66:187–99.
13 Gündüz K, Bechrakis NE. Exoresection and endoresection for uveal melanoma. Middle East Afr J Ophthalmol. 2010;17(3):210–6.
14 Suesskind D, Scheiderbauer J, Buchgeister M, Partsch M, Budach W, Bartz-Schmidt KU, et al. Retrospective evaluation of patients with uveal melanoma treated by stereotactic radiosurgery with and without tumor resection. JAMA Ophthalmol. 2013;131(5):630–7.
15 Dunavoelgyi R, Dieckmann K, Gleiss A, Sacu S, Kircher K, Georgopoulos M, et al. Local tumor control, visual acuity, and survival after hypofractionated stereotactic photon radiotherapy of choroidal melanoma in 212 patients treated between 1997 and 2007. Int J Radiat Oncol Biol Phys. 2011;81(1):199–205.