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Coexisting Choroidal and Brain Metastases in a Patient with Breast Cancer Treated with Stereotactic Radiotherapy

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Keywords
Choroidal metastases · Breast cancer · Stereotactic radiotherapy · Gamma knife

Abstract
Choroidal metastases from breast cancer are the most common ocular malignancies in adults. We report a case of a 37-year-old female with a history of breast cancer who had a sudden blurred vision in her right eye. An ophthalmologic assessment revealed a dome-shaped lesion and a secondary retinal detachment with subretinal fluid in the left eye, suggestive of choroidal metastasis. Moreover, an MRI scan showed the presence of a single brain lesion. The patient was treated with stereotactic radiotherapy, with 300 cGy for 10 days. Six months after treatment, there was a regression of the mass and improvement of visual acuity. Stereotactic radiotherapy is a safe and effective treatment for choroidal metastases and should be considered to treat coexistent choroidal and brain metastatic lesions, to improve survival, visual function, and quality of life.

Introduction
Choroidal metastases are the most common ocular malignancies that affect the adult population [1, 2]. In particular, breast cancer is the leading cause of metastasis to the anterior uvea and choroid, with an incidence from 9.7 to 47% [2, 3]. Previous studies reported a
survival rate of 65% at 1 year and 24% at 5 years after diagnosis of choroidal metastasis in patients with breast cancer [4].

Recent technologic improvements in ophthalmology and the introduction of diagnostic instruments such as optical coherence tomography (OCT) and ultrasound scan (US) allow a thorough eye examination and an early diagnosis of choroidal metastases [1]. However, there is currently no consensus on the treatment strategy [1]. Although external beam radiation therapy is the most widely used treatment, more innovative procedures of radiotherapy with fewer side effects, such as gamma knife stereotactic radiotherapy, can be proposed in select cases [5, 6]. In this paper, we present a case of a woman with single choroidal and brain metastases treated with stereotactic radiotherapy.

**Case Report/Case Presentation**

A 37-year-old woman, with a history of breast cancer (estrogen receptor-positive and progesterone receptor-positive) previously treated with a mastectomy of her left breast and chemotherapy, presented with a recent sudden vision in her right eye. At presentation, corrected distance visual acuity was 20/63 in the right eye and 20/20 in the left eye.

Biomicroscopic examination of the anterior segment was unremarkable, and the lens was clear in both eyes; intraocular pressure was 13 mm Hg in the left eye and 15 mm Hg in the right eye. Fundus examination revealed a whitish area in the inferior-temporal retina in the right eye, whereas the left eye was normal. Moreover, the patient underwent extensive further diagnostic investigations comprising bulbar ultrasound and OCT.

OCT showed deformation of the retinal profile due to the presence of convexity with a retained foveal depression and a secondary retinal detachment with subretinal fluid containing bright dots and speckles (shown in Fig. 1). Furthermore, there was also an outer retinal degeneration with shaggy photoreceptors and an irregular and lumpy bump anterior choroidal surface, with compression of the choriocapillaris (shown in Fig. 1).

B-scan showed a dome-shaped lesion with poly-lobular contours, a “wax cast” appearance with irregular reflectivity, and a secondary retinal detachment with subretinal fluid (shown in Fig. 2). Additionally, A-scan revealed medium to high internal reflectivity at the location of the thickened choroidal mass that showed irregular peaks and a “V” aspect of the layout (shown in Fig. 2).

**Fig. 1.** a OCT demonstrating the presence of retinal convexity with a retained foveal depression. b Retinal detachment with the subretinal fluid.
Ultrasonography was useful for measuring dimensions and thickness of the mass, revealing a choroid lesion with a size of 5.54 mm, located in the inferior-temporal sector and extending to the ora serrata. Moreover, the patient also underwent an MRI scan which showed the presence of a single brain lesion. Due to the concomitant choroidal and brain metastatic lesion, the patient underwent stereotactic radiotherapy. The radiation dose of gamma knife radiosurgery was 300 cGy over 10 days with a total of 3,000 cGy.

Ten days after treatment, the US showed a reduction of the choroidal mass and OCT revealed a decrease of the subretinal fluid. At 6 months after the treatment, the retinal detachment was resolved, and the US demonstrated a significant reduction of the choroidal lesion to 2.88 mm (shown in Fig. 2, 3); moreover, BCVA in the right eye improved to 20/32.

**Discussion/Conclusion**

The recent improvements in ophthalmology and oncology have significantly changed the management and the outcome of patients with choroidal metastasis [1]. The multidisciplinary evaluation aims to consider the intraocular features of the metastatic lesions comprising number, location, and extent, as well as visual potentiality and life expectancy of the patient [1–5].
Indeed, advances in oncologic therapy have considerably improved the survival of patients who could preserve vision and therefore improve quality of life thanks to ocular treatments [1]. Although systemic treatments could also be beneficial for choroidal metastasis, there are few reports of breast cancer in the literature, mostly about hormonal receptor-positive cases [1].

However, patients acquire commonly resistance to systemic treatments, and local therapy may be necessary for durable control [5]. Moreover, a combination of systemic and local therapy is preferred in severe visual acuity [5].

In case of choroidal metastases refractory to systemic therapies, local treatments like external beam radiation therapy is preferred, requiring 2–4 weeks of multiple radiation fractions [4]. According to this therapeutic scheme, 40–60 Gy are administered.

Chu et al. [6] in their studies described a reduction in the volume of the metastasis in 85–93% of patients and an improvement in visual acuity in 56% of eyes. Although this procedure is effective and safe, complications such as cataracts, exposure keratopathy, iris neovascularization, radiation retinopathy, and optical neuritis have been reported in almost 12% of cases [7].

The introduction of stereotactic radiotherapy allows treating safely and accurately intraocular metastasis with tumor regression, improvement of symptoms, and reducing the ocular complications. Few cases of choroidal metastases treated with stereotactic radiotherapy are reported in the literature; however, this technique has several advantages allowing treatment of multiple metastatic districts simultaneously, using a minimum dosage of radiations and reducing significantly the time of treatment [8]

Lally et al. [5] reported the first case of complete regression of choroidal metastasis from breast cancer treated with a single session of stereotactic radiotherapy. However, Schmelter et al. [9] described 4 cases of uveal metastases treated with single-session radiosurgery, reporting 1 case of radiation retinopathy with subsequent neovascular glaucoma. Indeed, to reduce the possible retinal and choroidal radiation-induced side effects, some authors described cases safely treated with different sessions of stereotactic radiotherapy.

In our case, considering the coexisting choroidal and brain metastases, we decided for a fractionated stereotactic radiotherapy approach to get a complementary treatment of both districts. In conclusion, this report documented at 6 months after treatment an important...
reduction of the choroidal metastatic mass and resolution of the retinal detachment, with a significant improvement of visual function and quality of life of the patient.

The main goals of the treatment of metastatic disease are to improve the quality of life, ensuring patient autonomy, and improving progression-free survival [4–8]. Therefore, ophthalmologists must be familiar with the diagnosis, management, and treatment of choroidal metastasis.

Moreover, the choice of the therapeutic options is also essential and should be guided by randomized controlled studies, comparing different approaches, and considering the general status of the patient and cancer phenotypes. Our experience proves the effectiveness of stereotactic radiotherapy to treat concomitant choroidal and brain metastatic lesions; however, further studies are needed to evaluate the safety and efficacy of this technique.

Statement of Ethics

Written informed consent has been obtained from the patient to publish this paper. The ethics committee of University of Messina established that ethics approval was not required. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Conceptualization: Giovanni Roberto Tedesco and Alessandro Meduri; methodology: Giovanni William Oliverio; software: Giovanni Roberto Tedesco; validation: Giovanni Roberto Tedesco, Alessandro Meduri, and Pasquale Aragona; formal analysis: Giovanni William Oliverio and Claudia Azzaro; investigation: Giovanni Roberto Tedesco and Giovanni William Oliverio; resources: Claudia Azzaro; data curation: Giovanni Roberto Tedesco, Giovanni William Oliverio, and Claudia Azzaro; writing – original draft preparation: Claudia Azzaro; writing – review and editing: Giovanni William Oliverio and Alessandro Meduri; visualization: Alessandro Meduri; supervision: Pasquale Aragona; project administration: Pasquale Aragona. All the authors have read and agreed to the published version of the manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.
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