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Tumor control, eye preservation, and visual outcomes of ruthenium plaque brachytherapy for choroidal melanoma

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ABSTRACT

PURPOSE: To evaluate outcomes in patients with posterior choroidal melanoma treated with ruthenium (^{106}Ru) brachytherapy.

METHODS AND MATERIALS: A retrospective single institutional analysis of 83 of 94 consecutive patients who underwent ^{106}Ru brachytherapy was performed. Disease was mainly staged as small- and medium-sized nonmetastatic melanoma. The main parameters evaluated were tumor control (local control [LC] and progression-free survival [PFS]) and ocular preservation (enucleation-free survival [EFS]). Besides, functional evaluation was performed and complications were described.

RESULTS: The median follow-up was 39 (6–83) months. The median values of height and maximal basal diameter were 4.3 and 9.3 mm, respectively. Median apical and basal doses were 100 and 307 Gy, respectively. The actuarial 2-year LC, PFS, and EFS were 96.2%, 96.2%, and 95.5%, respectively. Actuarial 5-year LC, PFS, and EFS were 93.6%, 93.6%, and 84.1%, respectively. Preinsertion visual acuity (VA) maintenance was 34% (equal or better than before treatment). Approximately 56% of patients stayed with a minimum functional VA of 0.1 or more, from whom more than half stayed with 0.5 or more. Cataract was seen in 16% of treated eyes, and glaucoma was the rarest complication, with an incidence of 3%.

CONCLUSIONS: Small- and medium-sized choroidal melanomas can be adequately treated with ^{106}Ru brachytherapy, with high rates of tumor control and ocular preservation. Moreover, acceptable incidence of complications such as glaucoma and cataract are seen, and a reasonable part of patients stay with a minimum functional VA.

Keywords: Choroidal melanoma; Uveal neoplasms; Brachytherapy; Ruthenium-106

Introduction

Uveal melanoma is the most common primary neoplasm of the eye with an annual incidence of 4.3 per million and was historically treated with enucleation. Aiming at improving cosmetics and quality of life without compromising survival, alternative eye-sparing treatments such as brachytherapy, charged particle radiotherapy, stereotactic radiotherapy, local resection, and phototherapy were developed (1).

Several studies have shown that these conservative procedures do not increase the risk of distant metastasis and death (2, 3) and are reasonable alternatives to enucleation. The biggest one to assess the efficacy of brachytherapy was the Collaborative Ocular Melanoma Study (COMS) that included 1317 patients mainly with medium-sized choroidal melanoma and compared iodine (^{125}I) plaque to enucleation. There was no difference between these two treatments, with

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Conflicts of interest: None.

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comparable 5-year survival (81 vs. 82%) and 5-year death rates from distant metastasis (11% vs. 9%) (4).

The main purpose of brachytherapy seems to be proven after that (comparable cure). At present, the objectives are maintenance of vision and improvement of cosmetics and quality of life. Many isotopes were tested and since it was introduced, ^{106}Ru has been increasingly used.

In this context, it was decided to perform a retrospective review of our results with ^{106}Ru brachytherapy for small- and medium-sized posterior choroidal melanomas. The main parameters evaluated were tumor control (local control [LC] and progression-free survival [PFS]) and ocular preservation (enucleation-free survival [EFS]). Besides, functional evaluation was performed, and complications such as cataracts, visual acuity (VA), and glaucoma were described.

Methods and materials

The records from 94 consecutive patients with the presumed diagnosis of choroidal melanoma who underwent brachytherapy using ^{106}Ru between January 2004 and September 2008 at AC Camargo Hospital in São Paulo, Brazil were reviewed.

Inclusion/exclusion criteria

All patients were aged 18 or older at the time of implant and all of them signed an informed consent describing the possible toxicities from treatment and allowing future studies like this.

Patients with follow-up shorter than 6 months, those whose lesions were located at the anterior compartment, and/or those presenting metastases at the time of diagnosis were excluded. This study had ethics approval before initiation.

Technical parameters

Ruthenium applicators (CGD model—22.3 mm diameter, 6.1 mm height, and 13 mm radius) manufactured by Bebig (Eckert & Ziegel BEBIG GmbH, Berlin, Germany) were used.

The choice of the plaque diameter was made by adding 2–4 mm to the biggest tumor diameter to have a safety margin of at least 1–2 mm on each side.

A 100 Gy dose delivered by a minimum 0.6 Gy/h dose rate was prescribed at the apex for any lesion larger than 5 mm. Smaller lesions had doses delivered at 5 mm from their base. One millimeter corresponding to sclera thickness was added to the true height value. Dose to the base was then calculated (4).

Tumor size was classified according to the COMS criteria (5). The small tumors measured less than 2.5 mm in apical height and 5 mm or less in longest basal diameter, the medium tumors ranged from 2.5 to 10 mm in apical height and 16 mm or less in the longest basal diameter. The tumors classified as large had a longer basal diameter of more than 16 mm and height of more than 2 mm or an apical height of more than 10 mm.

The plaque was applied to the patient under general anesthesia, and the lesion localization was performed by direct visualization, transillumination, or indirect ophthalmologic examination. Patients remained hospitalized in appropriate rooms during the time of irradiation, and the plaque removal was made under general anesthesia as well.

Outcome measures

Tumor response was evaluated by fundoscopy and ultrasound. Local recurrence was defined by the presence of signals of tumor activity or documented growth.

Metastases were investigated routinely and in symptomatic patients. Disease progression was defined by any local or distant signal of tumor activity.

Appearance of cataract and glaucoma was evaluated based on citation in patient record. A measured eye pressure higher than 21 mm Hg defined glaucoma. Enucleation was performed owing to local recurrence or late toxicities, and these parameters were separately analyzed.

The main parameters evaluated were tumor control (LC and PFS) and ocular preservation (EFS). They were calculated using Kaplan–Meier survival curves. Besides, functional evaluation was performed, and complications such as cataracts, loss of VA, and glaucoma were described.

Results

Follow-up

Exclusion rules resulted in retaining only 83 of 94 patients who underwent 106 Ru plaque during this period. The main cause of exclusion was follow-up duration of less than 6 months (many patients did the follow-up at their original hospital). It resulted in a median follow-up of 39 (6–83) months.

Patients and tumor characteristics

Most of the patients were female, corresponding to 60% of all cases. From the total, 58% of the lesions occurred in the left eye. The median age was 60 (19–84) years, and comorbidities were not evaluated. Median treatment time was 3 days (minimum 2 and maximum 12 days). Tumor and treatment features are listed in Table 1.

Tumor control

There were eight enucleations—4 owing to tumor progression and four owing to toxicity—and only one distant failure (liver, lung, and central nervous system [CNS] metastasis after 72 months of treatment). There was no combined failure.