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Reirradiation of the eye with plaque brachytherapy: A single institution experience report of eight consecutive patients submitted to retreatment after local relapse of malignant disease of the eye

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ABSTRACT

PURPOSE: To evaluate the feasibility of reirradiation of the eye with plaque brachytherapy (REPBT) for local recurrence (LR) of malignant disease of the eye as an alternative to enucleation or other local salvage treatments.

METHODS AND MATERIALS: It was performed a retrospective analysis of all patients who underwent REPBT for LR. The main parameters evaluated were local control and progression-free survival, besides the toxicity profile.

RESULTS: There were eight patients who underwent REPBT, seven due to uveal melanoma and one due to retinoblastoma. The median time between the first plaque brachytherapy and the salvage plaque brachytherapy was 24 months (8–49 months). After a median followup of 30 months (8–70 months), the actuarial 2-year local control and progression-free survival was 87.5% and 60%, respectively. All patients evolved with worsening of the visual acuity and cataract. Other complications observed were maculopathy (two patients) and glaucoma (one patient).

CONCLUSIONS: REPBT should be considered as an option for salvage therapy of LR of malignant disease of the eyes as it provides a high probability of tumor control and eye preservation without compromising disease-free survival.

Keywords: Choroid melanoma; Uveal neoplasms; Retinoblastoma; Brachytherapy

Introduction

Primary malignant disease of the eye is an unusual neoplasm with an estimated incidence and mortality in 2012 in the United States of 2610 and 270, respectively (1). In adults, uveal melanoma (UM) is the most common diagnosed intraocular tumor with an annual incidence ranging from 4.3 to 5.1 per million (2, 3). The most affected site is the choroid representing 65.15% of the cases (2). On the other hand, among children, retinoblastoma (RB) is the most frequent tumor with an estimated incidence of 360 cases in 2012 (1).

Historically, these tumors were primarily treated with enucleation. An effort has been made to evaluate eye-sparing therapies, such as plaque brachytherapy (PBT), which has a goal of improving quality of life through better cosmetic and functional results without compromising local control (LC) (4–6).

Available literature shows that conservative approach is an excellent option of treatment for selected patients with equivalent overall survival (OS) and distant metastases (DM) rates when one compares enucleation vs. PBT (7).

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Local recurrence (LR) of ocular tumors (UV and RB) occurs rarely after PBT (8, 9). As to LC, the risk of enucleation and treatment failure at 5 years after PBT was 12.5% and 10.3%, respectively (8), with 90% of the patients maintaining a usual vision (5).

Although there are some options after LR, for instance, photocoagulation, transpupillary thermotherapy, or external beam radiation therapy, enucleation is the standard of care after PBT failure (10).

The LC rate usually achieved after PBT, the paucity of reports about reirradiation of the eye with plaque brachytherapy (REPBT) (11), and the high effectiveness of this treatment modality, as regard to LC, DM, and OS, have motivated us to perform a review of the cases who have underwent REPBT at our institution.

Methods and materials

We reviewed the records from eight consecutive patients who underwent REPBT with Iodine-125 (I-125) or Ruthenium-106 (Ru-106) between November 2003 and March 2009 at AC Camargo Hospital in São Paulo, Brazil. All of them had a recurrent ocular tumor after the first conservative treatment and were submitted to a salvage brachytherapy in the same eye.

Detailed technical aspects of the procedure have been described (4). This study had ethics approval before initiation. 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. The use of Ru-106 plaque was restricted to lesions lower than 5 mm height.

A dose of 100 Gy for melanoma and 40 Gy for RB was delivered by a minimum dose rate of 0.6 Gy/h at the lesion apex if it was greater than 5 mm and at 5 mm if it was smaller than this height. One millimeter corresponding to sclera thickness was added to the true height value (4). Dose to the base was then calculated and limited to a range between 250 and 400 Gy, to follow our institutional protocol.

Tumor response was evaluated by fundoscopy and ultrasound. LR was defined by the presence of documented growth, extrascleral extension of the tumor occurred after brachytherapy, or if the tumor initially responded to radiation and then recurred. 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.

The main parameters evaluated were LC and progression-free survival (PFS), which were defined since the date of the second PBT. They were calculated using Kaplan–Meier survival curves. For the analysis of PFS, we excluded the patient with RB because the progression pattern is different from melanoma. Functional evaluation was performed, and complications such as cataracts, loss of visual acuity, and glaucoma were described.

Results

Most of our patients were female, corresponding to 62% of all cases, with a median age of 59 years (4–62 years). Seventy-five percent of the tumors were located in the right eye. The diagnoses of the tumors were one RB and seven UM, six from the choroid and one arising from the iris.

All patients were initially treated with iodine plaque. The median time between the first PBT and the salvage PBT was 24 months (8–49 months). Tumors and treatment characteristics are listed in Table 1.

The median followup (FU) after REPBT was 30 months (8–70 months). The actuarial 2-year LC and PFS was 87.5% and 60%, respectively. DM was present in three patients; all of them had progression to the liver and died due to disease. The patterns of recurrence for each patient are described in Table 2. Actuarial Kaplan–Meier curves are showed in Figs. 1 and 2.

Concerning the toxicity issue, the complications are listed in Table 2. It was not necessary to enucleate any patient due to late complications of REPBT.

Table 1
Characteristics of the tumor initially and at recurrence

Patients	Diagnosis	H/DI 1[a]	Date 1	DB 1	DA 1	H/DI 2	I 2	ΔT	DB 2	DA 2
1	UM	3.96/8.73	11/11/03	260	105	6.00/6.50	I-125	45.5	331	99
2	UM	5.50/13.06	10/12/03	335	103	4.66/1.91	I-125	27.9	279	116
3	UM	8.13/11.51	05/08/04	321	108	3.26/6.38	Ru-106	22.2	356	96
4	UM	7.51/13.90	13/12/04	360	70	4.00/10.20	I-125	15.4	295	112
5	UM	4.08/6.60	17/02/05	263	120	3.40/6.30	I-125	49.6	258	87
6	UM	5.00/5.00	04/03/05	341	102	3.00/6.00	Ru-106	29.2	308	106
7	UM	3.25/16.73	03/07/06	344	112	6.25/6.50	I-125	8.6	308	106
8	RB	6.23/6.76	12/07/07	120	51	3.10/8.80	Ru-106	13.2	139	45
Median value	—	5.25/10.12	—	328	104	3.7/6.5	—	—	301	102

H = height (mm); DI = diameter (mm); 1 = refers to characteristics of the first plaque brachytherapy; Date = date of the first plaque brachytherapy; DB = dose base (Gy); DA = dose apex (Gy); 2 = refers to characteristics of the second plaque brachytherapy; I = radioactive isotope; ΔT = months between the first and the second plaque brachytherapy; UM = uveal melanoma; I-125 = iodine-125; Ru-106 = ruthenieum-106; RB = retinoblastoma.

[a] All patients were initially treated with iodine plaque.