



Clinical Study

Hemangiopericytoma: Radical resection remains the cornerstone of therapy



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ABSTRACT

Hemangiopericytomas (HPC) are mesenchymal tumors with a propensity towards chronicity and metastasis. This study aimed to reflect a single institution experience with both World Health Organization (WHO) grade II and III HPC. Pathology records from the years 1990–2013 at the University of Washington were searched to identify tumors unequivocally classified as HPC. Electronic chart review was then utilized to collect pertinent patient data. Of the WHO grade II HPC, there were four men and two women (average age 52 years) while the grade III HPC group had eight men and two women (average age 51 years). Sixty-six percent of WHO grade II tumors were located in the middle or posterior fossa as compared to none of the grade III tumors. Survival analysis revealed a significant survival benefit for patients who underwent complete resection (223 months) *versus* those with subtotal resection (138 months, $p < 0.05$). Factors such as age, sex, the use of up-front radiation, and whether the patient had a recurrence did not show statistical significance related to overall survival or progression free survival. Radiation in the form of external beam radiotherapy given at the time of the first recurrence did trend towards improved progression free survival (56 months) compared to those patients who were not radiated (22 months, $p = 0.09$). All patients with radical resection went on to never have a recurrence. Our results indicate that HPC are tumors with limited response to radiation and best treated with aggressive resection. Future studies will determine whether molecular-based therapies may provide added adjuvant benefit.

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1. Introduction

Hemangiopericytomas (HPC) are rare tumors, thought to comprise 2–3% of all primary meningeal tumors and 1% of all intracranial tumors [1–5]. Histologically, HPC is believed to arise from Zimmerman pericytes, which are contractile spindle cells surrounding capillaries in any part of the human body [1,2,6]. These tumors were previously thought to be angioblastic variants of meningioma; however in 1993 the World Health Organization (WHO) recognized these tumors as distinct clinicopathological entities on the basis of their histologic characteristics and their tendency to recur and metastasize extraneurally [1,7–13]. Academic progress on these entities has been halting, mainly because of their rarity and potential chronicity [1–12,14–40].

Recent literature has advocated gross total resection with or without postoperative external beam radiotherapy (EBRT) on the basis of one large series [1] and another meta-analysis [2]. As long term survival is quite possible with these tumors, particularly in

patients with gross total resection, the decision to radiate is critically important given that many patients are relatively young at the time of diagnosis. The purpose of this study was to evaluate the efficacy of gross total resection with radiation in a single institution series of 16 patients with a mean follow-up of 91 months.

2. Methods

The study involved 16 patients with primary HPC of the central nervous system who were treated at the University of Washington between 1990 and 2013. Patients were identified from histopathological records. Medical records were analyzed retrospectively to collect demographic, treatment, and outcome data.

The extent of tumor resection was established from operative notes and imaging review. Extent of tumor resection was defined using a modified Simpson grade with grade 1 delineating radical tumor resection with dural margins and bony drilling while grade 2 conferred subtotal resection status. Pathology reports were reviewed to confirm diagnosis and determine if the tumor was low or high grade on the basis of WHO criteria. With regards to radiation, modality (such as EBRT or Gamma Knife [Elekta AB,

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Stockholm, Sweden]) was recorded along with treatment dose. No patients received chemotherapy.

2.1. Follow-up data

Recurrence was defined as local tumor growth as identified on serial imaging. Local recurrences were treated with revision surgery followed by radiation when radical excision was not possible. Adjuvant radiation was performed if significant tumor bulk remained after the first operation. The modified Rankin scale (mRS) was used to assess quality of life at last follow-up.

2.2. Statistical analysis

Clinical data related to survival analysis was analyzed using the Statistical Package for the Social Sciences (SPSS, Chicago, IL, USA) using the Kaplan–Meier method [41]. Univariate comparison of parameters was performed using log-rank analysis. Multivariate analyses were not performed given the small sample size of the study population thus precluding meaningful results.

3. Results

Sixteen patients underwent microsurgical resection for HPC between 1990 and 2013. The minimum number of operations was one and maximum nine. There were three women (25%) and 13 men (75%) with a mean age at diagnosis of 51 years (range 24–74 years). The mean follow-up was 91 months (range 0.16–246 months). No patient was lost to follow-up. The mortality rate was 25%. The 5 year survivor rate was 70%. Only one patient developed extraneural metastases. The mRS score at last follow-up indicated a score of 0 (indicating independent symptom free life) for nine patients, a score of 6 (indicating death) for four patients, and a score of 3 (indicating mild disability but independent) for one patient. Twenty-seven percent of patients received up-front radiation mostly with EBRT (only one patient received up-front stereotactic radiosurgery).

3.1. Recurrence rate

Six patients (37.5%) developed local recurrence at an average of 59 months (range 9–117 months). Four patients suffered from a minimum of four recurrences and a maximum of nine. The average follow-up for those with recurrences was 164 months. Only one patient with recurrences died.

3.2. Factors affecting prognosis and recurrence

Univariate statistics were used to evaluate demographic and treatment data including extent of resection, up-front radiation, the use of multiple radiation treatments, age less than 40, sex, and the presence of recurrence with regards to mortality and tumor recurrence (Table 1, 2). Mortality was observed to be increased in tumors exhibiting high grade (40%) features compared to lower grade tumors, but not significantly so (0%, $p = 0.15$). Additionally, radical resection imparted a significant survival benefit with a mortality of 10% in completely resected tumors and 50% in subtotally resected tumors ($p = 0.04$, Fig. 1). Age, sex, and the use of radiation either up-front or repeated as salvage therapy did not impart a survival benefit (Fig. 2, 3).

With regards to progression, none of the studied factors seemed to significantly affect whether or not a tumor recurred. Notably, of the three tumors that recurred in the subtotally resected group, all three were completely removed at the time of recurrence with no further recurrence following the second operation.

Table 1

Factors affecting mortality in patients with hemangiopericytoma

	Mortality	<i>p</i> value
HPC grade	Low 0% High 40% ± 16%	0.15
Surgical excision	Grade 1 10% ± 9% Grade 2 50% ± 22%	0.04
Up-front radiation	None 22% ± 14% EBRT 29% ± 18%	0.39
Multiple radiation	Yes 16% ± 15% No 30% ± 15%	0.29
Age < 40 years	Yes 25% ± 24% No 25% ± 13%	0.50
Recurrence	Yes 14% ± 13% No 33% ± 16%	0.20

BBRT = external beam radiotherapy, HPC = hemangiopericytoma. Data are presented as mean ± standard error of the mean.

Table 2

Factors affecting hemangiopericytoma tumor recurrence

	Progression	<i>p</i> value
HPC grade	Low 16% ± 17% High 50% ± 16%	0.10
Surgical excision	Grade 1 30% ± 15% Grade 2 50% ± 22%	0.22
Up-front radiation	Yes 29% ± 0.18% No 44% ± 17%	0.71
Age < 40 years	Yes 75% ± 25% No 25% ± 13%	0.04

HPC = hemangiopericytoma.

Data are presented as mean ± standard error of the mean.

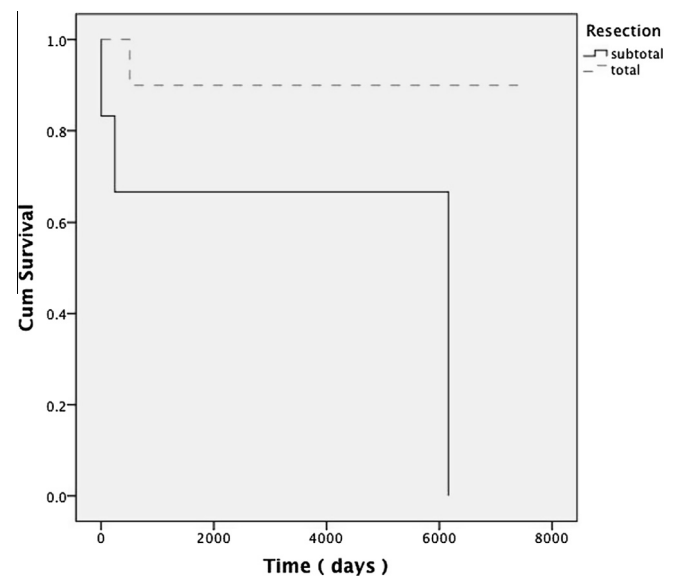


Fig. 1. Kaplan–Meier survival curve showing radical resection imparts significantly increased survival (median 6708 days) compared to subtotal resection (median 4147 days, $p = 0.04$). Notably, there were six high grade tumors in the total resection group thus suggesting extent of resection affects overall survival independent of tumor grade. Cum = cumulative.

4. Discussion

HPC are rare and potentially aggressive lesions. Recent case series and meta-analyses have revived the debate regarding the role of radiation in the treatment of these lesions [1,2]. We present a series of 16 patients with central nervous system HPC treated at a single center. The most notable findings included the lack of effect of

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