Advances in Radiation Oncology (2016) 1, 89-93

advances
in radiation oncology

www.advancesradonc.org

Scientific Article

An analysis of prognostic factors associated with recurrence in the treatment of atypical meningiomas

Christian Fernandez BA [a,b], Martin K. Nicholas MD [c], Herbert H. Engelhard MD, PhD [d], Konstantin V. Slavin MD [d], Matthew Koshy MD [a,b,*]

[a] *Department of Radiation Oncology, University of Illinois at Chicago, Chicago, Illinois*
[b] *Department of Radiation and Cellular Oncology, The University of Chicago, Chicago, Illinois*
[c] *Department of Neurology, University of Illinois at Chicago, Chicago, Illinois*
[d] *Department of Neurosurgery, University of Illinois at Chicago, Chicago, Illinois*

Received 11 November 2015; received in revised form 13 January 2016; accepted 2 March 2016

Abstract

Background: There has been increased reporting of atypical meningioma (grade II) since the World Health Organization reclassification in 2000, and the use of postoperative radiation therapy (RT) in the treatment of these tumors is controversial. We evaluated patients treated at our institution to identify patient subgroups with increased risk of recurrence that may benefit from adjuvant RT.

Methods and materials: We retrospectively assessed 50 patients treated for World Health Organization grade II meningiomas between March 2000 and February 2013. Sex, race, age of diagnosis, tumor location, performance status, size of tumor, MIB-1 index, resection status, and RT were recorded. Patient follow-up, recurrence, and vital status were measured to assess 3-year overall survival (OS) and recurrence free survival (RFS).

Results: The median follow-up was 37 months (range, 1-148). Female sex was associated with decreased RFS compared with male sex (86.1% vs 100%, $P = .047$). Subtotal resection demonstrated both inferior RFS (67.5% vs 96.6%, $P = .025$) and OS compared with gross total resection (70.0% vs 100%, $P < .001$). Tumors >4.5 cm had worse RFS than tumors ≤4.5 cm (85.4% vs 100%, $P = .025$). Patient OS was lower in tumors with an MIB-1 index >5% than ≤5% (89.7% vs 100%, $P = .008$). Eastern Cooperative Oncology Group 2-4 negatively impacted OS relative to patients with an Eastern Cooperative Oncology Group 0-1 (66.7% vs 100%, $P < .001$).

Conclusions: Significantly higher rates of recurrence occurred in female sex, subtotal resection, and tumors larger than 4.5 cm. Further studies are needed to confirm these findings and determine whether patients without any of these risk factors can undergo surgical resection without adjuvant radiation therapy.

Conflicts of interest: None.

* Corresponding author. Department of Radiation Oncology, University of Illinois at Chicago, 1801 West Taylor Street, Chicago, IL 60612, USA
E-mail address: mkoshy@radonc.uchicago.edu (M. Koshy)

http://dx.doi.org/10.1016/j.adro.2016.03.001

Introduction

Meningiomas represent 36% of all primary brain neoplasms in adults and are the most commonly reported central nervous system tumors.[1] The incidence of meningiomas is approximately 6-7 in 100,000, and increases with age. They are often an incidental finding during autopsy or imaging.[1] Pathogenesis is believed to be initiated by genetic loss of chromosome 22q12, with tumor aggressiveness corresponding to degree of genomic instability.[2] Meningiomas are categorized histologically based on the World Health Organization (WHO) classification system as grade I (benign), grade II (atypical), and grade III (anaplastic), representing 80%, 15% to 20%, and 1% to 3% of all meningiomas, respectively.[3]

The WHO classification system underwent a significant revision in 2000 and an update in 2007.[4,5] These changes allowed clearer definitions of variants and resulted in a redistribution of many patients into different classes, with better correlation between grade and tumor behavior. Many originally "benign" or "malignant" meningiomas were reclassified as atypical, increasing the incidence of grade II from previously reported 5% to 7% to the current numbers of approximately 20% to 35%.[6,7] The sudden increase in reported grade II, and corresponding correction of reported grades I and III, meningiomas has obfuscated previous clinical data regarding outcomes and management.[8]

Given the increase of atypical meningiomas classified under the new guidelines, the need for reassessment of the current treatment approach is of growing importance.[9,10] Although gross total resection (GTR) is known to be critical, there is no consensus on the role of adjuvant radiation therapy (RT) in the treatment of atypical meningiomas, resulting in inconsistencies between institutions.[11] Although prospective trials are in development (European Organization for Research and Treatment of Cancer 1308, Radiation Therapy Oncology Group 0539), the results of these studies will not be available for some time.[12,13]

In this study, we analyzed outcomes of atypical meningiomas diagnosed in the modern treatment era at a single institution and assessed prognostic factors related to overall survival (OS) and recurrence free survival (RFS), with a focus on recurrence as these patients may warrant greater consideration for RT.

Methods

Patients

Fifty patients were treated for grade II meningiomas at the University of Illinois Hospital in Chicago, Illinois, between March 2000 and February 2013. This study was approved by the University of Illinois institutional review board. Electronic medical records (EMRs) were reviewed and clinical information recorded. Sex, race, age of diagnosis, tumor location, MIB-1 index, size of tumor, and RT status were documented. Preoperative performance status was retrospectively assessed using the Eastern Cooperative Oncology Group (ECOG) score. Meningioma grading via the 2007 WHO classification system was verified based on pathology reports along with MIB-1 status. Preoperative radiology reports were used to confirm tumor location and size based on largest single dimension.

Treatment

Extent of resection was based on surgical operative notes and post-operative imaging. GTR was defined as Simpson 1-2 and subtotal resection (STR) as Simpson 3-4. Pursuit of RT, dose, and modality were also recorded. Patient follow-up and vital status were based on medical record review, patient contact, and Social Security Death Index query.

Analysis

Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 22. Date of diagnosis was defined as the date of surgical resection and was used as the starting date for OS, with survival measured until date of death or last follow-up. RFS was measured starting at date of resection until tumor growth was noted on routine follow-up imaging or until symptom development, verified by imaging. Kaplan-Meier curves and log-rank tests were used to compare groups for OS and RFS. Univariate analysis of each variable (sex, age, resection status, tumor size, MIB-1 status, ECOG status, tumor location, and RT) was conducted. Results from analysis were deemed significant at $P < .05$.

Results

Patient characteristics

A summary of patient characteristics is available in Table 1. Median age of diagnosis was 58 years (range, 26-82) and median follow-up was 37 months (range, 1-148). The cohort was predominately female (64%) with an ECOG of 0-1 (72%). Tumor locations were categorized as convexity (40%), parasagittal/falx (12%), skull base (30%), intraventricular (12%), and spinal (6%). Tumor size was not available in 4 patients because of incomplete medical records; these patients were excluded from analysis of size. A cutoff of 4.5 cm was used as this was the average greatest single dimension in our patient base. Tumor size was >4.5 cm in 52%, ≤4.5 cm in 40%, and unknown in 8% of