Analysis of Growth Rate Among Meningiomas Selected for Observation Without Treatment

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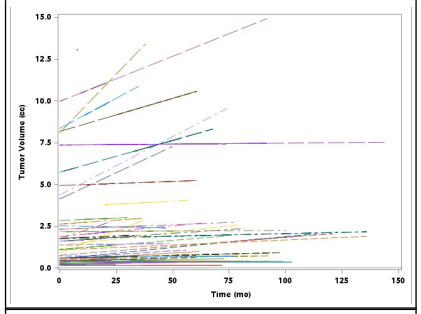
Introduction

For small or asymptomatic meningioms, the decision to observe rather than treat requires balancing the growth potential of the lesion, patient age and expected longevity with the consequences and side effects of treatment. There is no consensus on whether or not the growth of these lesions is exponential, linear, or Gompertzian. This study aims to improve the clinical decision-making process and advance our understanding by characterizing the natural growth patterns of presumed meningiomas encountered at our institution

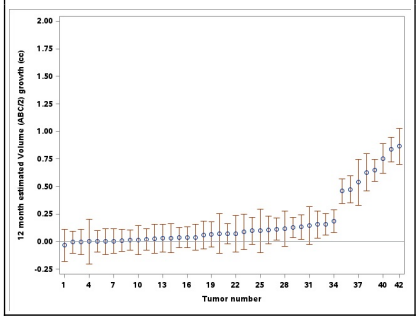
Methods

Patients with presumed meningiomas were identified from tumor-related diagnoses at VCU between 2005 and 2015. Inclusion criteria: 1) received no treatment; 2) follow-up for at least 18 months; and 3) At least 3 MRI scans. Tumor dimensions were measured with orthogonal diameters, geometric mean diameters (GMDs) and volumes using the ABC/2 method (simplified ellipsoid volume). Chart review extracted patient age at initial diagnosis, gender, and tumor location.

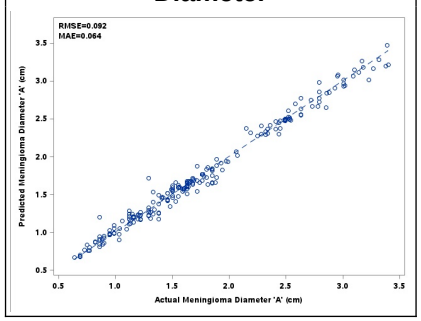
Volume over Time of Each Tumor



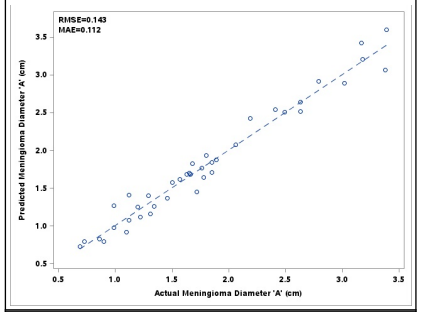
Growth Rate of Volume of each Tumor



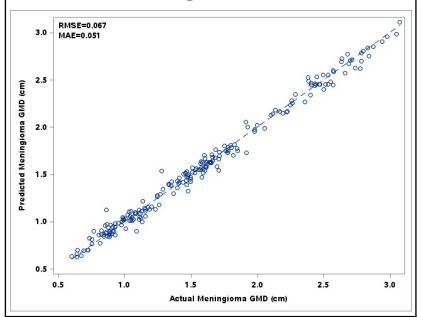
Predicted Diameter by Actual Diameter



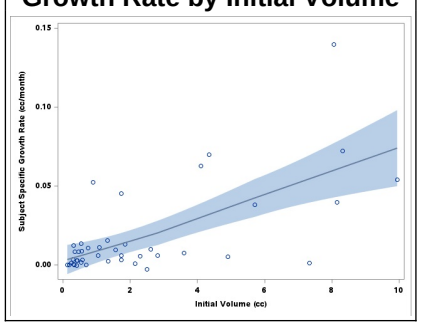
Predicted Diameter by Measured Diameter Dropping Last Value



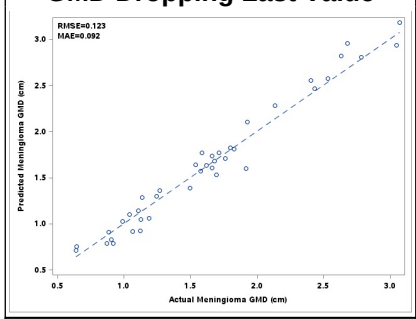
Predicted GMD by Measured GMD



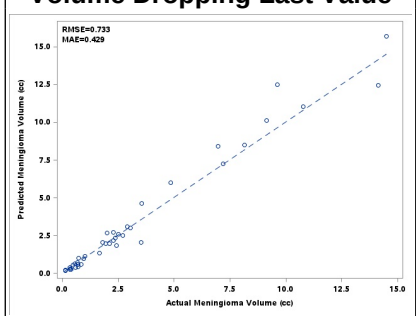
Growth Rate by Initial Volume



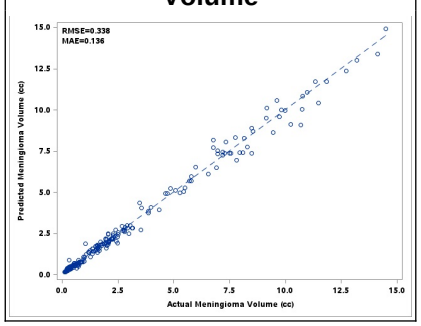
Predicted GMD by Measured GMD Dropping Last Value



Predicted Volume by Measured Volume Dropping Last Value



Predicted Volume by Measured Volume



Results

A total of 34 female (85%) and 6 male (15%) patients with 43 tumors contributed 213 scans for evaluation. Tumor volume ranged from 0.11 to 14.5cc with mean of 3.18cc and median of 1.95cc. Median follow-up duration was 70 months (range 19 to 144). Regression analysis diameters and volumes identified 22 tumors (55%) with growth not significantly different from zero. The remaining 21 tumors had growth rates with slopes ranging from 0.11 to 1.95 mm/year for the maximum diameter, 0.09 to 1.78 mm/year for GMD and 0.03 to 2.03 cc/year for volume.

Conclusions

Analysis of imaging from a population of untreated patients with presumptive meningiomas demonstrates approximately half of tumors managed conservatively have zero growth. The remainder of tumors have growth that cen be approximated by linear regression model. This allows quantitative approximation of future growth that should facilitate clinical decision-making regarding management choices.