Intracranial meningioma natural history

Many incidental intracranial meningiomas are detected and need to be assessed for further management. Better knowledge of the long-term natural history is necessary for optimal management

Despite the increased detection of incidental or small meningiomas, the lesion's natural history is largely unknown.

One year or longer of follow-up was conducted in 244 patients with 273 meningiomas managed conservatively by a single surgeon between 2003 and 2008. Data were stratified according to age, sex, tumor location, symptoms, initial tumor diameter, calcification, MR imaging intensity, and edema. Linear tumor growth was defined as a 2-mm or larger increase in the maximum diameter in any direction of the tumor. Volumetric analysis (ImageJ version 1.43) was also conducted in 154 of 273 meningiomas for which complete radiological data were available in the form of DICOM files throughout the follow-up period. A volume increase greater than 8.2% was regarded as significant because the preliminary volumetry based on 20 randomly selected meningiomas showed that the average SD was 4.1%.

Linear growth was observed in 120 tumors (44.0%) with a mean follow-up of 3.8 years. Factors related to tumor growth were age of 60 or younger ($p = 0.0004$), absence of calcification ($p = 0.027$), MR imaging T2 signal hyperintensity ($p = 0.021$), and edema ($p = 0.018$). Kaplan-Meier analysis and Cox proportional hazards regression analysis revealed that age 60 or younger (hazard ratio [HR] 1.54, 95% CI 1.05-2.30, $p = 0.026$), initial tumor diameter greater than 25 mm (HR 2.23, 95% CI 1.44-3.38, $p = 0.0004$), and the absence of calcification (HR 4.57, 95% CI 2.69-8.20, $p < 0.0001$) were factors associated with a short time to progression. Volumetric growth was seen in 74.0% of the cases. Factors associated with a higher annual growth rate were male sex ($p = 0.0002$), initial tumor diameter greater than 25 mm ($p < 0.0001$), MR imaging T2 signal hyperintensity ($p = 0.0001$), presence of symptoms ($p = 0.037$), and edema ($p < 0.0001$).

Although the authors could obtain variable results depending on the measurement method, the data demonstrate patients younger than 60 years of age and those with meningiomas characterized by hyperintensity on T2-weighted MR imaging, no calcification, diameter greater than 25 mm, and edema need to be observed more closely. Volumetry was more sensitive to detecting tumor growth than measuring the linear diameter [1)].

In 47 asymptomatic patients, hospital charts, follow-up records, and imaging studies were reviewed. Of these patients, 6 underwent surgery. Tumor growth rates were determined by calculating the absolute and relative growth rates and the tumor volume doubling times.

In 41 patients with conservative management, the average tumor size was 9 cm(3), and the majority (66%) of growth rates were less than 1 cm(3)/yr. The absolute growth rate ranged from 0.03 to 2.62 cm(3)/yr (mean, 0.796 cm(3)/yr). Relative annual growth rates ranged from 0.48 to 72.8% (mean, 14.6%). The tumor doubling time ranged from 1.27 to 143.5 years (mean, 21.6 yr). A moderate correlation between the age and growth rates was found. In young patients, annual growth rates tended to be higher and tumor doubling times shorter. There was no clear correlation between the initial tumor size and tumor doubling time. The mean annual growth rate of meningiomas with calcification was lower than in tumors without calcification. Also, tumors with hypointense or

isointense T2 signals on magnetic resonance imaging had a lower growth rate. In the group of six patients with surgical excision, tumor growth rates were higher and tumor doubling times shorter than in the nonsurgical group.

The majority of incidental meningiomas show minimal growth; thus, they may be observed without surgical intervention unless specific symptoms appear. Tumor growth is associated with patient age. The initial tumor size is not considered a predictive factor for tumor growth. Radiological features, such as calcification or T2 signal intensity, may provide useful information to predict the growth potential of meningiomas [2)]

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2)
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