

Long-term follow-up of 32 meningiomas of the clivus and foramen magnum subjected to stereotactic radiosurgery

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Abstract

Introduction: Meningiomas of the clivus and foramen magnum are infrequent, and are difficult to treat surgically because of their location, access, and the associated vascular and nerve structures. Such lesions are often candidates for stereotactic radiosurgery (SRS).

Objective: A retrospective analysis is made of the results of SRS in 32 patients subjected to a mean follow-up period of 6.5 years.

Material and methods: A total of 32 patients with a mean age of 55.13 ± 13.36 years were studied. Twenty-four were women (75%). Tumor location: clivus (20 cases, 62.5%), clivus and cavernous sinus (6 cases, 18.75%), and foramen magnum (6 cases, 18.75%). Sixteen patients (50%) had undergone prior surgery 12.2 ± 12.8 months before SRS. Mean tumor volume (TV) as determined by MRI before SRS was 16.390 cm^3 (range $0.065\text{--}48.25 \text{ cm}^3$). In 16 cases (50%) the size was equivalent to a sphere of diameter >3 cm. SRS was carried out with a linear accelerator, high-precision positioning system and mechanical fixation of the tertiary collimator (SRS 200 - University of Florida, USA). Three-dimensional planning with image fusion was carried out. The mean dose was 1400 cGy (1200 - 1600) prescribed to the 90% mean isodose line. The mean maximum dose was 18.56 Gy (13.46-43.43 Gy). In 19 cases (59.37%) coverage of the TV was partial.

Results: After a mean follow-up of 6.5 years (2.2-11.3), significant TV reduction was observed (final TV $13.49 \pm 13.37 \text{ cm}^3$, $p < 0.001$). A reduction in size was recorded in 22 cases (68.75%), with stabilization in 7 (21.8%), and an increase in TV in 3 (9.4%). Tumor control (reduction plus stabilization) was achieved in 29 patients (90.6%). The prior symptoms improved in 16 cases (50%), remained without change in 13 (40.6%), and worsened in 3 (9.4%).

Conclusions: SRS provide a effective and safe management strategy for meningiomas of the clivus and foramen magnum being a clear alternative of microsurgical removal, with a reduction or stabilization of the tumor volume in 90.6% of cases. Such treatment can be used in patients of all ages, under unfavorable clinical conditions, and in application to tumor remnants or relapse.

Introduction

Meningiomas are benign and generally slow-growing tumors derived from the dura mater. They are the most frequent non-glial primary tumors, and the most common extra-axial neoplasms of intracranial location, with an incidence of 2-3 cases per 100,000 individuals/year.¹ The incidence is greater in women and in patients diagnosed with breast cancer.

Since these are benign lesions, surgery is the standard treatment - complete resection being curative in 90% of cases, with reduction of the neurological symptoms and mass effect.²

Meningiomas of the clivus are infrequent, and the proximity of critical neurovascular elements makes their surgical treatment difficult. Historically, the surgical management of meningiomas in this location has been associated with important morbidity and mortality. Since the seventies, with the development of microsurgical techniques and advances in neuroimaging studies, the treatment of these lesions has improved considerably, though in many cases complete tumor removal (Simpson 1) remains difficult, with important neurological sequelae.³ Some meningiomas of the clivus can extend to the cavernous sinus, and in such cases surgery proves controversial.⁴

Meningiomas of the foramen magnum account for only 1.8-3% of all meningiomas.⁵ The surgical management of such lesions entails a risk of permanent complications and mortality of 8% and 4%, respectively.⁶

Due to the characteristics of meningiomas, with a low α/β index, these tumors are radiobiologically ideal for treatment with a single irradiation fraction. As a result, stereotactic radiosurgery (SRS) is very appropriate in such cases. The meningioma control rate with SRS is 90-95%, with a low morbidity risk.

