GKRS for Meningiomas Extending to the Extracranial: An Initial Analysis

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Objectives: Meningiomas are, in its majority, benign extra-axial tumors originating from arachnoid cells and in 20%, they eventually develop an extracranial extension. They project more frequently towards the orbit, followed by the external table of the calvaria, the nasal cavity and paranasal sinuses, and the parapharyngeal (cervical) space. In the last, it extends mainly through the jugular and lacerate foramina. We present the initial results of a retrospective evaluation of the meningiomas with extracranial extension treated with Gamma Knife Radiosurgery (GKRS) from 2010 to 2024 with the goal to analyze their treatment response, and symptomatic outcomes.

Methods: Retrospective review of all meningiomas treated with GKRS in the last 14 years that presented extracranial extension, excluding calvary and air sinus. Patient demographic, symptomatology, WHO grade, KI-67%, history of prior radiation to CNS, surgeries and associated diseases, tumor extension localization, extension through foramen or hyperostosis progression, treatment data, outcome and time of follow-up were analyzed. Point-biserial correlation and Cohen's kappa coefficient were used to analyze data correlation.

Results: Total of 29 patients were identified, 22 were female, with a mean age of 62 years (42-83 years) and mean follow-up of 15 months (3-166 months). Most common site of extension was the pterygopalatine fossa (12), followed by orbit (11) and jugular foramen (7). Due to tumor volume, 2 cases presented extension to pterygopalatine fossa and orbit. Foraminal extension was observed in 18 cases and hyperostosis in 11. Eight cases presented multiple meningiomas but only 1 had confirmed neurofibromatosis, with 3 other patients with secondary meningiomas after prior CNS radiation (ALL, CLL, astrocytoma). 13 patients had surgical procedures with pathological confirmation, the others being diagnosed based on MRI, with the majority (9) being WHO I. Their Ki-67% varied between 2 and 35% (median of 4%). Based on the WHO reclassification from 2021, 2 cases would have been reclassified as WHO II and 2 as WHO III. Breakdown data shown on Table 1. Dose for single treatments were 12Gy, 15 Gy and 17Gy to WHO I, II and III respectively. Hypofractionation varied from 5-7Gy per fraction. Nine patients presented new symptoms (transitory in 66%), 5 had temporary worsening, 4 improved and 17 had no change. Table 2 and 3. Despite 34% required retreatment, at the end of the follow-up, 31% had volumetric decrease, 58.6% were stable and only 6.9% increased. Point-biserial and Cohen's Kappa showed no correlation between KI-67% with new or worsening symptoms (Rpb=0) and with retreatments (Rpb=.09); retreatment had no correlation with localization (Rpb=.13) or multiple meningiomas (K=.03, p=.8) and had poor correlation with prior radiation (K=.14, p=.2).

Conclusion(s): In our series, meningiomas reached the extracranial space by extending through the foramen in its majority, specially to the pterygopalatine fossa and orbit. In the latter, symptoms were related to vision change, diplopia and proptosis by affecting cranial nerves, soft tissue and by mass effect. The tumors extending through the jugular foramen and pterygopalatine fossa tended to have their symptomatology related to the intracranial segment of the tumor rather than by their extension.

Data correlation was limited by the small number on this series. GKRS had 93% of local tumor control and 90% of symptom control.