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OBJECTIVE

Stereotactic radiosurgery for metastatic cavities of the brain has been used with the goal of increasing local control and OS. The latter is mainly associated with the type of the primary tumor, clinical and systemic status. Adverse radiation effects, such as edema, happens in 10% to 20% and it can be associated with location, treatment dose, use of immunotherapy, tumor's biology and volume. Management may require the use of steroids and anti-VEGF-A. The long-term behavior of the cavity's volume and post-radiation edema in patients who received Gamma Knife Radiosurgery (GKRS) for post-surgical metastatic cavities are poorly discussed in the literature and we present our initial data on them.

METHODS

Retrospective review of patients treated with GKRS for brain metastasis cavities. Patient and tumor characteristics were analyzed, including treatment parameters. Initial and final cavity's volumes were obtained with assistance of the Leksell GammaPlan based on the T1-MRI with contrast, using the scans from the treatment day and from the last follow-up. Edema was measured in its larger axis on T2-MRI on the same fashion. Dexamethasone and bevacizumab use was separated into none, early (up to 3 months from treatment) and late (more than 3 months). Point bi-serial and Pearson's correlation were utilized to calculate the desired associations.

RESULTS

A total of 51 patients and 73 treatments were analyzed over the period of 11 years (December 2007 to June 2019). Dose varied from 7 Gy (boost after whole brain radiation) and 30 Gy (mean of 17.3 Gy). The dura was included in the PTV in 55 treatments, not included in 11 and, in another 7 cases, it was not included due to deep localization of the target. Only 1 patient had a 5mm margin added to the GTV, the others had PTV = GTV. 39 patients responded with an 83% volume reduction (6-100%) and 12 patients required retreatment with a volume increase of 114% (15-848%). Two patients developed leptomeningeal disease during the follow-up period. 47 patients received dexamethasone to which 20 had only within 3 months from treatment, 5 had only after 3 months, and 22 had early and late courses of steroids. Only 1 patient had bevacizumab (early) for symptomatic edema control. Treatment dose correlated with final edema status ($R=-.18$) but neither early or prolonged steroids use had significant impact on it ($R_{pb}=.06$ and $R_{pb}=-.02$, respectively). Although edema did not have an impact on survival, the reduction of the cavity's volume was associated with a better a local control ($R_{pb}=.11$, $p<0.005$) and overall survival ($R=.29$, $p=.04$).

CONCLUSION

Peri-lesional edema is a common observation in metastatic tumors and can be affected by multiple factors and therefore, making it hard to correlate it with patient's outcome. A progressive reduction on the cavity's volume will correlate with local control and have a direct impact on survival.

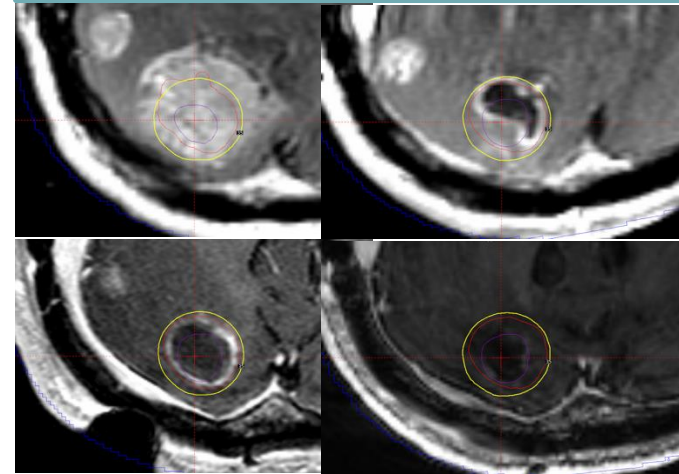


Figure 1: Top left: Pre-operative cerebellar metastasis. Top right: Post-operative cavity 24 hours after resection. Bottom left: Cavity at the time of Gamma Knife (red structure), the lateral lesion was treated at the same time. Bottom right: One year follow-up with significant reduction of the cavity volume (purple structure) and improvement of the contrast ring enhancement (lateral lesion with complete response).