Brain Metastases Radiation Treatment Based on Total Tumor Volume
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Introduction
Whole brain radiation therapy (WBRT) and stereotactic radiosurgery (SRS) are commonly used to manage brain metastases. Criteria for using either or both modalities are widely studied and debated. This study analyzes the treatment outcome of SRS, specifically CyberKnife Radiosurgery, based on the total tumor volume compared to the absolute number of lesions.

Methods
A retrospective analysis of hospital records at Virginia Hospital Center for patients with brain metastases who underwent CyberKnife Radiosurgery between June 2008 and June 2014 was performed. Previous treatment history, metastatic tumor dimensions, and outcomes were recorded. Predictors of neurological defects, local tumor progression, and overall survival were assessed with univariate and multivariate analysis.

Multivariate Cox Regression Analysis
Unfavorable outcomes including death, tumor progression, and worse neurological function showed an association with total tumor volume greater than the median volume of 7cc and no history of WBRT. New or worsening neurological function showed an association with age and number of lesions treated with CyberKnife while survival’s only negative predictive variable was the number of lesions treated with CyberKnife.

Relative Risk of Tumor Progression
For local tumor progression, patients who have received WBRT were less likely to progress (.74, 95% CI .48, 1.10), while those who received chemotherapy (1.48 95% CI .98, 2.26), or surgery (1.56 95%, CI .98, 2.47) without WBRT were more likely to progress.

Conclusions
The results suggest correlation between a cumulative tumor volume greater than 7 cc and worse outcomes following SRS. Furthermore, WBRT in addition to SRS appears to be beneficial for patients with increased tumor burden. A prospective study is warranted to validate these findings.

Learning Objectives
1. The limitations of current brain metastasis treatment guidelines.
2. Contrast between number and total volume of brain metastases as criterion for radiation therapy.
3. The role of combination therapies involving SRS for brain metastases.

Publication
This study has been published in Journal of Clinical Neuroscience under “Cumulative Volumetric Analysis as a Key Criterion for the Treatment of Brain Metastases.”

Total volume as SRS Criteria
A tumor volume less than the median volume of 7 cm3 provided the best predictor of favorable outcome (OR .10, 95% CI .01–1.0; p < .05) with sensitivity of 98.3%, specificity of 10.7%, positive predictive value of 52.3%, and negative predictive value of 86.3%. The area under the ROC curve for the model is .83.