Cureus

Multi-Site, Multi-Variate Analysis of Stereotactic Radiosurgery Cases and Patient Outcomes

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Abstract
Published 04/02/2023

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Categories: Radiation Oncology
Keywords: metastatic small cell lung cancer, immunotherapy, brain metastases, stereotactic radiosurgery

How to cite this abstract
Watermann M L, Mani S, Thamaravelil S, et al. (April 02, 2023) Multi-Site, Multi-Variate Analysis of Stereotactic Radiosurgery Cases and Patient Outcomes. Cureus 15(4): a849

Abstract

Objectives:

Stereotactic Radiosurgery (SRS) or Stereotactic Radiotherapy (SRT) both show positive trends in use for the treatment of brain metastases due to highly conformal treatments. Their popularity has grown in-part due to being favorable over traditional whole-brain radiotherapy for increased quality of life in patients with longer life expectancies. This study assesses a myriad of treatment factors over 218 SRS/SRT-treated patients with brain metastases to gain insight into how concerted therapies may be further optimized to improve patient outcomes. The impact of immunotherapy on adenocarcinoma, non-adenocarcinoma, and small cell lung cancer prognoses was of particular interest in this dataset. The Graded Prognostic Assessment (GPA) tool is also independently assessed as a component of this research.

Methods:

A total of 218 patients underwent SRS or SRT procedures for the treatment of brain metastases across four different LINAC-based radiotherapy outpatient centers with four different radiation oncologists in the Houston, TX area from 2018-2021. Patient data was de-identified and collected from an electronic medical record system to evaluate multiple variables including: lesion number and volumes, histopathology, dosimetry information, incidence of recurrence and necrosis, related treatments (e.g. resection, whole brain radiotherapy, immunotherapy, etc.), age, and survival status. Survival data is in reference to first treatment for brain metastases until expiration or last follow-up. The diagnosis-specific GPA tool was utilized retrospectively to compare actual survival data with GPA projections to both independently validate its use in our clinics and to serve as a benchmark for standard of care. Primary cancers comprised 126 lung, 32 breast, 13 renal, 11 GI, 5 melanoma and 31 other. Breast, renal, melanoma, GI and other cancers were not analyzed as in-depth subsets because of insufficient sample sizes for specific cell types.

Results:

The average age of the cohort at time of first SRS/SRT treatment was 63.9 years of age. 207 cases had sufficient follow-up time for one-year survival (47.8%) and 150 met two-year criteria (30.0% survival). 55 patients had surgical resection before SRS/SRT treatment with a 1-year survival of 64.8% versus 41.8% for non-resection patients (152). However, local recurrence for resection patient was 14.5% versus 6.1% for non-resected. Average survival for patients with 1, 2, 3 and >3 lesions at time of first SRS/SRT treatment were 18.6, 17.5, 14.4, and 14.0 months respectively. No statistically significant relationship of SRS/SRT doses with survival was observed in this dataset. No discernible impact of immunotherapy on recurrence was seen. Brain metastases from lung cancer were assessed in more detail due to larger samples of specific cell types. Lung adenocarcinoma with immunotherapy had a 72.9% 1-year survival versus 23.8% without immunotherapy. Similarly, lung non-adenocarcinoma and small cell patients fared much better with immunotherapy than without (59.1% versus 15.8% and 63.6% versus no 1-year survival respectively). Lung adenocarcinoma, non-adenocarcinoma and small cell overall lesion volume at time of first SRS/SRT showed notable influence on 1-year survival when comparing patients with less than or greater than 4 cc total lesion volumes. For adenocarcinomas the difference was 60.0% versus 46.7%, 40.0% versus 38.1% for non-adenocarcinomas, and 40.0% versus 20.0% for small cell.

Conclusion(s):

Unlike many similar studies, most of our cohort’s metastases originated from lung cancer primaries which have severe prognoses. Overall one-year and two-year survival percentages for all SRS/SRT-treated patients was 47.8% and 30% respectively. This data demonstrates general consistency with retrospective GPA survival prognosis and is comparable to large, previous studies showing 42.4% overall survival rate at 1-year and about 25% at 2-years. Immunotherapy had significant impact on 1-year survival for various types of lung cancers in agreement with past research. Patients with a resection followed by SRT had higher 12-month survival (64.8% versus 41.8%). However, local recurrence rates were higher for resected patients at 14.5% versus 6.1% for non-resected - a trend supported by published meta-analysis. Dose did not seem to play a significant role in overall survival, but volume and number of lesions had some relevance.