Hypofractionated Radiosurgery for the Treatment of Large Brain Metastases and Post-resection Cavities

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Introduction

Cerebral metastases represent the most common intracranial tumors, arising in 10-40% of all cancer patients. The treatment paradigm for the management of these lesions has increasingly employed stereotactic radiosurgery (SRS), both alone and after surgical resection. However, recent studies suggest worsened local control rates and increased risk of adverse radiation-associated complications following SRS in patients with larger tumor volumes. Here, we reviewed our experience with the treatment of large metastatic brain lesions and post-operative cavities using a uniform frameless fractionated regimen (fSRS).

Table 1: Demographic Data

	n=118	n=51	n=67
Variable	**All Patients**	**Cavity**	**Tumor**
Sex (M/F)	59/59	26/25	33/34
Age (y)			
Median	59	59	60
Range	31, 92	34, 82	31, 92
Histology			
NSCLC	56 (47%)	32 (63%)	24 (36%)
SCLC	5 (4%)	0 (0%)	5 (7%)
Breast adenoca	14 (12%)	2 (4%)	12 (18%)
GI adenoca	6 (5%)	3 (6%)	3 (4%)
Melanoma	23 (19%)	6 (12%)	17 (25%)
RCC	7 (6%)	6 (12%)	1 (1%)
Other	7 (6%)	2 (4%)	5 (7%)
KPS			
Median	70	70	70
60-70	60 (51%)	28 (55%)	32 (48%)
80-100	55 (47%)	23 (45%)	32 (48%)
Number of Metastases			
Single	62 (53%)	31 (61%)	31 (46%)
Multiple	56 (47%)	20 (39%)	36 (54%)

Methods

A retrospective analysis was performed for patients with large (>2.5 cm) intracranial metastatic lesions or post-surgical cavities treated with 5-fraction frameless SRS (30 Gy) using a Novalis linear accelerator over a 6-year period (2009-15). Patient outcomes, including survival, local control, distant failure, and rates of radiation necrosis were recorded.

Results

We reviewed 118 patients with metastatic lesions. Of these, 51 (43%) were post-operative cavities with a median volume of 16.0 cc (IQR 12.4-25.8 cc) and 67 (57%) were metastatic tumors with a median volume of 10.9 cc (IQR 6.3-13.6 cc). The most common primary pathologies were non-small cell lung cancer (47%), melanoma (19%), breast cancer (12%), renal cell carcinoma (6%), and colon cancer (5%). Median survival was 6.0 months (IQR 2.3-14.5), with improved survival in patients undergoing resection prior to fSRS (10.0 months (IQR 3.7-18.7) vs. 5.0 months (IQR 2.2-10.4)). Local tumor control was observed in 89.8% of lesions at 6 months post fSRS, and in 84.7% at 12 months. Distant failure was recorded in 22.0% of patients at 6 months and 32.2% of patients at 12 months. Notably, patients who underwent pre-fSRS resection were more likely to develop distant failure (45.1% vs 29.2%; p=0.013). Finally, 8 patients (6.8%) developed symptomatic radiation necrosis with a median interval of 7 months from treatment.

Table 2: Safety/Efficacy Data

	n=118	n=51	n=67
Variable	**All Patients**	**Cavity**	**Tumor**
Diameter of Treated Lesion (cm)			
Average	3.3	3.5	3.1
Median	3.0	4.0	3.0
IQR	2.8, 3.8	3.0, 3.9	2.7, 3.3
Tumor Volume (cc)			
Average	15.5	21.4	10.9
Median	12.0	16.0	8.0
IQR	7.0, 17.7	12.4, 25.8	6.3, 13.6
Overall Survival (mo)			
Average	12.2	17.4	8.2
Median	6.0	10.0	5.0
IQR	2.3, 14.5	3.7, 18.7	2.2, 10.4
Local Tumor Control			
6 months	89.8%	90.2%	89.6%
12 months	84.7%	86.3%	83.6%
Distant Failure			
6 months	22.0%	29.4%	16.4%
12 months	32.2%	45.1%	22.4%
Radiation Necrosis			
Asymptomatic	7 (5.9%)	2 (3.9%)	5 (7.5%)
Symptomatic	8 (6.8%)	4 (7.8%)	4 (6.0%)

Conclusions

The treatment of large metastatic tumors and surgical cavities with a uniform hypofractionation regimen of 30 Gy in 5-fractions achieves an excellent local control rate (>80% at 12 months) with low risk of radiation necrosis (<10%).

Learning Objectives

By the conclusion of this session, participants should be able to 1) describe the primary challenges in the application of SRS to large metastatic intracranial lesions 2) understand the potential of hypofractionated regimens in the management these large lesions.