

Factors Predictive of Improved Overall Survival Following Stereotactic Radiosurgery (SRS) for Recurrent Glioblastoma (GBM)

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Learning Objectives

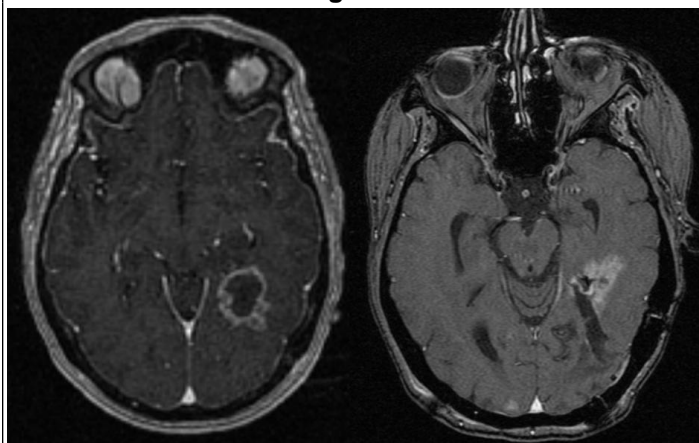
By the conclusion of this session, participants should be able to:

- 1) Describe the importance of patient, tumor and treatment factors in the prediction of overall survival following a diagnosis of glioblastoma.
- 2) Discuss the treatment options for primary as well as recurrent glioblastoma.
- 3) Identify appropriate candidates for stereotactic radiosurgery based upon demographic and treatment variables.

Introduction

Efficacy of stereotactic radiosurgery in improving median survival for the treatment of GBM has been historically mixed, with most current evidence supporting its usage as a salvage or boost therapy at the time of recurrence. The adjuvant treatment of GBM with SRS at our institution is reviewed.

Figure 1



Pre-operative and post-recurrence imaging of left temporo-occipital GBM

Results

36 patients underwent 41 adjuvant treatments for GBM. 7 underwent SRS in the immediate post-operative period, following biopsy or subtotal resection, with median overall survival of 4.5 months (range 0.4-25.6 mo). 29 patients were treated for a recurrence at a median of 273 days from initial resection, with significantly increased median overall survival of 19.4 months from diagnosis and 7.9 months from recurrence ($p = 0.0063$). 8 of these were initially treated with standalone external beam radiotherapy (EBRT) following resection, with the remaining 21 receiving EBRT and chemotherapy with either BCNU or temozolomide. A mean lesion volume of 11.1cc received a mean maximum dose of 27.9 Gy, with a prescribed dose ranging from 10-20 Gy at the 50% isodose line.

Table 1

	n (%)
Male Sex	22 (61.1%)
Caucasian race	32 (88.9%)
Treatment	
Chemotherapy	28 (77.8%)
Temozolomide	15 (53.6%)
Radiation	
External Beam	31 (86.1%)
Whole brain	8 (22.2%)
	Median
Age at diagnosis (yr)	52
Age at death (yr)	54.5
Overall Survival (mo)	18.8
From recurrence (mo)	7.9
GKR Dose (Gy)	14
Lesion Volume (cm ³)	9.5

In subset analysis, treatment volume, maximum and prescribed dose, chemotherapy choice (carmustine vs. temozolomide), time to recurrence and age at diagnosis all failed to demonstrate significant effect on median survival. Withholding of systemic chemotherapy ($n=8$) additionally showed no statistical effect on survival; however in those patients not undergoing EBRT ($n=5$), median survival fell precipitously (19.2 vs. 2.5 months $p=0.0001$).

Table 2

Treatment	n	Median survival (mo)	p
Immediate GKR	7	4.5 (0.4-25.6)	0.0063
GKR at recurrence	29	16.5 (2.0-1248.1)	

Conclusions

Salvage therapy with SRS following GBM recurrence has demonstrated statistical superiority over upfront post-operative boost therapy. The previously established survival advantage of post-operative EBRT has been verified.

References

1. Souhami L, Seiferheld W, Brachman D, et al. Randomized comparison of stereotactic radiosurgery followed by conventional radiotherapy with carmustine to conventional radiotherapy with carmustine for patients with glioblastoma multiforme: report of Radiation Therapy Oncology Group 93-05 protocol. *Int J Radiat Oncol Biol Phys* 2004;60:853-60.
2. Thumma SR, Elaimy AL, Daines N, et al. Long-term survival after gamma knife radiosurgery in a case of recurrent glioblastoma multiforme: a case report and review of the literature. *Case Rep Med* 2012;2012:545492.
3. Biswas T, Okunieff P, Schell MC, et al. Stereotactic radiosurgery for glioblastoma: retrospective analysis. *Radiation Oncology* 2009;4:11.
4. Elliott RE, Morsi A, Kalhorn SP, et al. Vagus nerve stimulation in 436 consecutive patients with treatment-resistant epilepsy: long-term outcomes and predictors of response. *Epilepsy Behav* 2011;20:57-63.
5. Hsieh PC, Chandler JP, Bhangoo S, et al. Adjuvant Gamma Knife Stereotactic Radiosurgery at the Time of Tumor Progression Potentially Improves Survival for Patients with Glioblastoma Multiforme. *Neurosurgery* 2005;:684-92.
6. Kong D-S, Lee J-I, Park K, et al. Efficacy of stereotactic radiosurgery as a salvage treatment for recurrent malignant gliomas. *Cancer* 2008;112:2046-51.