Stereotactic Radiosurgery for Intracranial Metastases from Gastrointestinal Malignancies: A Retrospective Analysis

Muhammad Fazal BSc, MSc; Anand Mahadevan MD; Ekkehard Matthias Kasper MD, PhD
Division of Neurosurgery and Department of Radiation Oncology, Beth Israel Deaconess Medical Center. Boston University School of Medicine. Harvard Medical School.

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Background

CyberKnife Stereotactic Radiosurgery (CK-SRS) delivers focused radiation to a target volume with a dose that can ablate tissue (e.g. tumor). It is therefore considered an effective alternative to surgery (Chan, Cardinale, & Loeffler, 2004)

Previous studies have assessed the efficacy of SRS in treating brain metastases (BM) from cancers such as lung, kidney, and skin and reported high local control rates (Selek et al., 2004). However only a handful of studies exist on the use of SRS for brain metastases from cancers of the GI tract and the existing literature focuses on cancers of the colon and rectum.

This study aims to assess SRS as a treatment option for brain metastases from GI cancers as well as evaluate its efficacy and associated prognostic factors that confer better or worse outcome for patients with regards to survival and local control.

Methods and Participants

This study was conducted as a retrospective analysis of a database on patients who have undergone CK-SRS treatment for BM from primary GI cancers at BIDMC. A total of 57 lesions from 18 patients who had undergone CK-SRS were identified from the IRB approved longitudinal database.

Patients either received SRS alone or in conjunction with surgery and/or whole brain radiation therapy.

Imaging studies for each individually treated lesion were carefully reviewed pre-treatment and at pre-determined follow up intervals (1, 3, 6, 12, 24 months) after treatment.

Outcome measures of this study were: Overall Survival (OS), calculated as the time from diagnosis of brain metastases to time of death; Local Control Rate (LCR); number of treated lesions achieving local control (i.e. No tumor growth and no post-SRS complications).

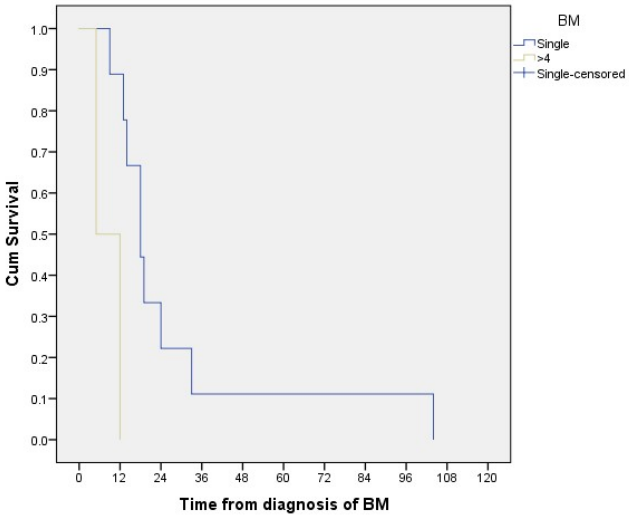
Patient Characteristics: Male (67%); Median age: 57 years; Median KPS: 80; Median number of BM: 1.5; Primary Cancer; Colon (50%), Rectum (22%), Esophagus (28%); Extracranial disease: 14 patients (78%); RPA class: 1 (22%), 2 (72%), 3 (6%); DsGPA: 0 (6%), 1 (33%), 2 (17%), 3 (28%), 4 (17%).

Results: Overall Survival

Treatment modalities and patient cohort:

SRS alone: 4 patients (22%); Surgery + SRS: 11 patients (61%); WBXRT + SRS: 3 patients (17%).

The median overall survival (mOS) for the entire cohort was **14 months** (95% CI 7.1-20.9) after diagnosis of BM.



KM Plot Overall Survival: Single metastasis (18m) vs Multiple metastases (4m). (P=0.006)

Patients receiving SRS alone did the worst with mOS of 8 months (mostly due to local failure (1-year LFR = 61.8%)); the WBXRT+SRS group had a mOS of 13 months (only 3 patients in group); and the Surgery+SRS group did the best with mOS of 18 months. The effect of treatment on survival was not found to be statistically significant (P=0.611).

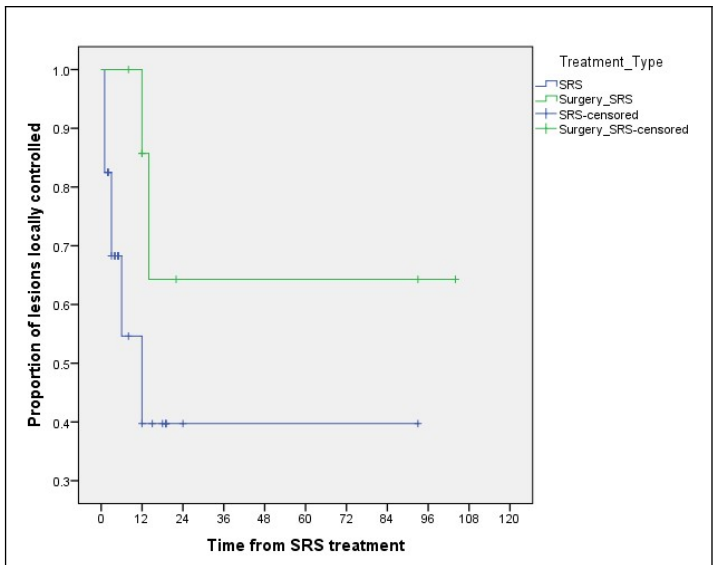
Cox analysis of prognostic factors affecting OS. (HR: Hazard Ratio)

Variable	HR univariate	P value univariate	HR multivariate	P value multivariate	mOS
KPS >70	0.77	0.62	0.35	0.16	18
Extracranial mets	2.23	0.22	3.28	0.13	13
Multiple BM	1.52	0.41	2.01	0.27	12
Treatment:SRS	1.00		1.00		8
Surgery + SRS	0.43	0.18	0.34	0.13	18
WBXRT + SRS	0.69	0.65	0.32	0.23	13

Results: Local Control

Lesions which were treated with SRS only, were locally controlled in 55% compared to 75% of lesions that were surgically resected prior to SRS.

The 1-year LCR of SRS alone was 38.2% compared to 85.7% for lesions that were resected prior to SRS treatment (P=0.013).



KM Plot Tumor Control: SRS alone vs Surgery + SRS

Conclusions

With significantly higher local control rates, and higher median overall survivals, surgery followed by SRS boost to the resection cavity should be considered the treatment of choice for brain metastases from GI cancers. SRS alone seems less effective to control disease in its current regimen which is likely due to microscopic extensions of these tumors resulting in recurrence.

Limitations and Future Directions

The limitations of the study include its retrospective nature, limited number of patients, and a possible treatment selection bias inherent in such non-randomized cohort studies. The indications observed in this study must be validated in a larger multicenter study using Frailty models to avoid improper weightage.