

# A New Measure for the Gamma Knife Radiosurgery Response: The Slope and Plot of Tumor Volume Changes First Evaluated for Melanoma Brain Metastases

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## Introduction

Reporting simple tumor volume changes (smaller, no change, larger) after radiosurgery is inadequate to define the radiobiologic effect. We hypothesized that the slope and appearance of the volumetric response plot would define the radiobiologic effect for specific lesions, radiosurgical techniques, and/or devices. We tested this concept using brain metastases from melanoma.

## Methods

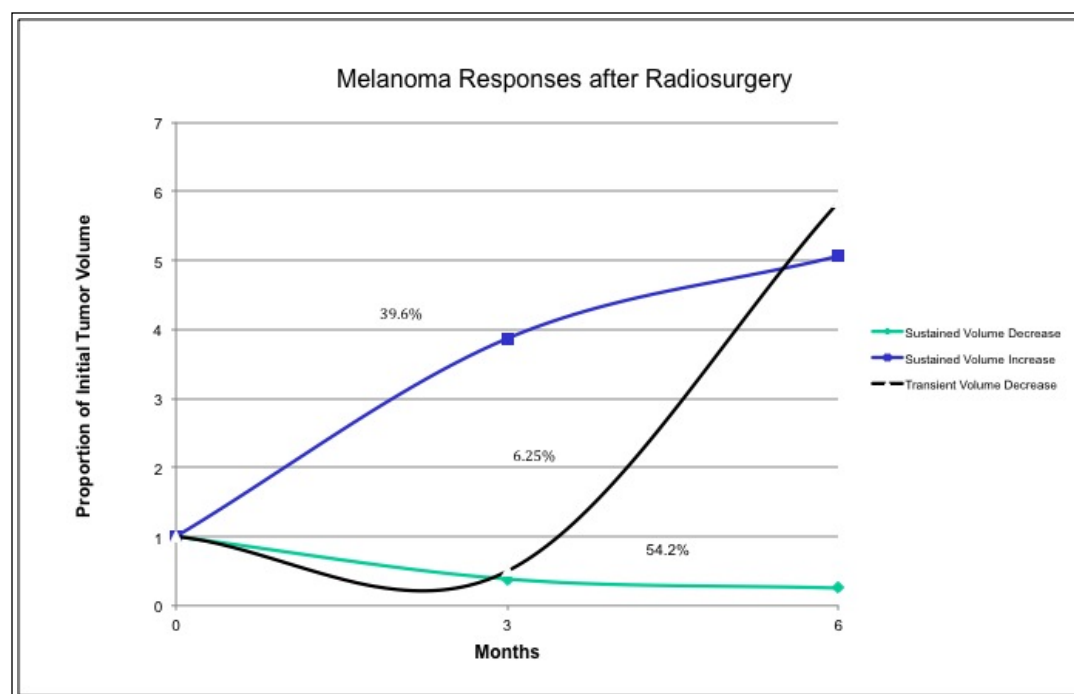
Serial post-radiosurgery MRI images were evaluated in 48 patients who underwent Gamma knife radiosurgery between 2002 and 2008 for brain metastases from melanoma. Patients received between 16 and 20 Gy to the tumor margin (median 18). The largest tumor was selected for each patient and its volume measured over time using available software. Patients were imaged from 1 month to 20 months following radiosurgery (median, 3 months).

## Results

The overall treated tumor control rate was 68%. 54% of the patients had sustained volume decrease, while 6% had transient volume control with an eventual increase in tumor size during the observation period. Of the 48 patients reviewed, 40% had sustained growth during the observation period. For patients who demonstrated overall tumor control, the reduction in tumor volume occurred most rapidly in the first three months following Gamma knife radiosurgery (mean reduction 56%). A later volume increase was due to either to early tumor growth, intratumoral hemorrhagic expansion, or regional contrast enhancement due to radiation effects.

## Conclusions

The tumor volume response after Gamma knife radiosurgery is dynamic; the reduction in tumor volume is most pronounced in the three-month interval after radiosurgery for patients who demonstrate overall tumor control. However, the mean tumor volume change in the first three months following radiosurgery may be less meaningful as a barometer for overall tumor control as non-responders' tumors grow at a significantly greater rate than responders' tumors reduce in size. The slope and appearance of the response curve in the initial months following radiosurgery may facilitate comparisons with other tumor types, radiosurgical techniques or technologies.



## Learning Objectives

To show if the slope and appearance of the volumetric response plot would define the radiobiologic effect for specific lesions, radiosurgical techniques, and/or devices.

## References

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