

## Gamma Knife Radio Surgery

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**Gamma knife radiosurgery (GKRS) is a radiation therapy used to destroy benign or malignant tumors as well as other lesions in the body. This technology is continuously advancing and growing throughout the medical field. With the cancer patient ratio and the negative side effects of other radiosurgery treatments both rising, this technology must continue to be researched and altered to be more effective and safer than it already is. With the general effectiveness and safeness of this treatment being one of the highest, researchers are now looking into the side effects/outcomes of the surgery, and the possible correlation between treatment success and patient/tumor characteristics.**

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### Introduction

Gamma knife radiosurgery (GKRS) is a treatment method that uses radiation therapy to treat tumors and/or other abnormalities that would otherwise be inaccessible or inadequate for open surgery. In this type of surgery, doctors use specialized equipment to send hundreds of beams of radiation into a tumor or other type of brain abnormality. Typically gamma knife radiosurgery is a one-time treatment completed in one-day, but certain circumstances can arise to where one may have to have another treatment. Gamma knife radiosurgery results in little to no damage of the surrounding tissue, and has been known to be safer and have lower risks of side effects in comparison to other radiation treatment methods. Unlike with other radiation treatments with GKRS the tumor is not removed however the cells in the tumor are deactivated therefore causing the cells to cease reproduction leading to cell death.

### Recent Progress

Currently, researchers have been conducting tests to try and determine whether or not differences in tumor or patient characteristics play a role in tumor radiosensitivity. These different characteristics range from histology to the size and oxygenation status of the tumor. Doctors have found that small cell carcinomas seem to be more radiosensitive in comparison with adenocarcinomas (K. Kosaki et al. 2012). Similarly they are finding that smaller tumors are more radiosensitive than larger tumors

(K. Kosaki et al. 2012). This notion would make sense being that there is less mass and the cells are smaller therefore the cells are easier to penetrate and kill. As well, there will be fewer clonogenic cells in a smaller tumor; therefore fewer cells will have the option to replicate leading to a more radiosensitive cell (K. Kosaki et al. 2012). Researchers have also begun to wonder if there will be a difference in the outcome of gamma knife radiosurgery between morning surgeries and afternoon surgeries (Rahn et al. 2010). Some tests have been done to try and determine this but no significant evidence has been found that supports this question (Rahn et al. 2010). Some researchers have brought up the question wondering what the clinical outcomes would be if the doctors altered the MRI-based treatment plans between 1.5 T and 3.0T (Loganathan et al. 2012). After varying the plans the researchers found that those treated with 1.5T MRI-treatment plan balanced out with those treated with the 3.0T MRI-treatment plan (Loganathan et al. 2012). While there is continuous research being conducted to try and solve the questions concerning gamma knife radiosurgery, there will always be new questions and new information arising.

Advancements in GKRS are a must but researchers are beginning to wonder whether radiosurgery is the most cost effective treatment method. In a study conducted in 2012 scientist compared stereotactic radiosurgery (SRS) treatment to surgical resection (SR) treatment and found that SRS had a lower average cost

per patient than SR in the treatment of brain metastasis (Duong Anh Vuong et al. 2012). Therefore Radiosurgery is a more cost-effective treatment method in comparison with other surgical methods. To determine the costs the researchers took into consideration the first treatment as well as retreatment costs of more potentially life-saving procedures until death or during the 5.5 years of follow up (Duong Anh Vuong et al. 2012). Some aspects that help SRS to be more cost-effective are that it is performed as an outpatient procedure using local anesthetic whereas SR uses general anesthetic and is not outpatient (Duong Anh Vuong et al. 2012). This study also found that with repeated SRS treatments, patient's survival time was significantly influenced (Duong Anh Vuong et al. 2012) therefore, not only is it more cost-effective, it also seems to be a more effective treatment method overall.

### Discussion

While there has been strenuous research completed in the field of gamma knife radiosurgery, there are still many questions to be answered. Some of these would be whether or not the gamma radiation would have any long term effects on the tumors primary organ, weather the stage of the tumor when treated effects the recovery or after effects, or whether the age, status, health of the patient has any role in the effectiveness of the treatment.

### References

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