



## Short Communication

# How Useful are 3-monthly MRI Surveillance Scans after Stereotactic Radiosurgery for Brain Metastases? A Single Institution Experience

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## Background

An estimated 20-40% of patients diagnosed with a primary cancer will develop brain metastases during the course of their disease [1]. This number is increasing due to the development of novel systemic therapies that improve patient survival and allow more time for intracranial metastases to develop. In addition, advances in the quality and availability of Magnetic Resonance Imaging (MRI) have enabled earlier detection of brain metastases, often before patients are symptomatic, and improvements in the targeted treatment of brain metastases allow people to live longer with intracranial disease.

Historically, surgery where suitable, or Whole Brain Radiotherapy (WBRT) have been the standard treatments for patients with brain metastases. Andrews, et al. [2] demonstrated that addition of Stereotactic Radiosurgery (SRS) to WBRT improves overall survival compared to WBRT alone in patients with 1 to 3 brain metastases. The use of SRS alone, compared with SRS combined with WBRT, resulted in less cognitive deterioration at 3 months with no difference in overall survival [3]. As such, SRS is routinely recommended without WBRT, reducing both early and late toxicity and especially neurocognitive side effects.

The main drawback to treating brain metastases with SRS without WBRT, is the increase in the rate of distant intracranial Progressive Disease (PD) when potential microscopic disease is left untreated (48% at 2 years [4]). Patients treated with SRS for brain metastases are recognised as being at risk of developing local or distant intracranial PD and measures to optimise the early detection of intracranial recurrence are increasingly important to allow further treatment because they can have a significant impact

on a patient's survival and quality of life.

The National Comprehensive Cancer Network (NCCN) guidelines recommend follow up with MRIs every 2-3 months in the first 1-2 years after SRS and every 4-6 months indefinitely thereafter [5]. The National Institute of Health and Care Excellence (NICE) in the UK suggests the same follow up schedule but with annual scans from two years after the end of treatment [6]. Despite these guidelines, there is little data on the optimal timing for surveillance and its impact on the quality of life and overall survival of patients.

A retrospective study by Wolf, et al. concluded that the earlier initial detection and prompt treatment of small intracranial metastases may prevent the development of neurological symptoms and the need for resection and may improve overall survival. The authors recommended routine surveillance brain imaging for patients with metastatic melanoma, lung and breast malignancies. Detecting asymptomatic progressive disease after SRS may therefore, allow earlier treatment with additional SRS. This may improve neurological outcomes and, potentially, overall survival.

Following SRS for brain metastases at our institution, we recommend close surveillance by the referring primary teams and advise 3-monthly surveillance MRI imaging. Our study aimed to assess the level of adherence to this recommendation by primary teams and to evaluate how many asymptomatic brain metastases had been detected on surveillance imaging post-SRS.

**Keywords:** Brain metastases; BM; Stereotactic radiosurgery; SRS; Magnetic resonance imaging; MRI

## Methods

The study was approved by the hospital's Institutional Review Board.

We identified patients treated for brain metastases with SRS in the definitive or post-operative setting at our institution from May 2016 to May 2020. We excluded patients who died within three months of SRS. We retrospectively reviewed the case notes and recorded the dates of every MRI scan performed after SRS. We calculated the number of patients who had regular MRI follow up, defined as performing a brain MRI within 3 months after radiotherapy and at least every 104 days thereafter (3months +/- 2weeks).

The indication for each post-treatment MRI scan was assessed. We documented whether the scan was requested as routine surveillance or performed because of the development of neurological symptoms. Finally, we collected data on any patients who were re-treated with SRS for intracranial disease progression.

## Results

A total of 206 patients treated for brain metastases with SRS were identified. 1,138 MRI scans were performed during the study period. Of these, 1009 scans were routine surveillance scans and 129 were performed to investigate new symptoms, which included headaches, vomiting, seizures or focal neurological symptoms. 42 patients (20%) had 3-monthly scans, as advised, until the end of the study period or date of their death. Of the 164 patients who did not have regular MRI scans, 95 had died at the time of our analysis. A total of 17/164 failed because they missed the scan before their death. Fifteen of these missed the scan within 6 months of their death and 12 of these missed the scan within 3 months of their death. In 90% of these cases, it was not just the scan that preceded the patient's death that was missed or delayed, suggesting that non-adherence to our surveillance policy was not only due to patients becoming too unwell for a scan.

38 patients (18%) had no MRI scans at all after their treatment. Of these patients, 4/38 were still alive at the time of our analysis and the median survival of the 34 patients who had died was 152 days i.e. <6 months. Table 1.

Tumour Type	Number of patients treated with SRS	Percentage of patients who received regular MRI follow-up after radiotherapy
GI lower	7	0%
Gynae	11	9%
Lung	65	14%
GI upper	6	17%
Renal	16	19%
Breast	57	30%
Melanoma	26	31%
Other	18	17%

**Table 1:** Percentage of patients by tumour type who had regular MRI scans until the end of the study period or date of death

A total of 45 patients (22%) were re-treated with SRS for locally recurrent lesions or, more commonly, lesions distant to a previously treated brain metastasis. Of these, 36/45 patients (80%) were re-treated as a result of a surveillance scan demonstrating intra-cranial progression of disease while they were asymptomatic. Within these 36 patients, 7 had regular 3-monthly MRIs. An additional 9 patients missed one MRI only and an additional 8 patients missed two MRIs in the study period. The remaining 9/45 (20%) were re-treated after developing symptoms and radiological disease progression.

## Conclusion

In our study, only 20% of patients had 3-monthly surveillance MRI brain scans after treatment with SRS for brain metastases. A likely contributory factor to this low compliance is that patients became unfit for further imaging or treatment. Patients are only eligible for further SRS if they have a prognosis of 6 months or more and therefore MRI surveillance may not be appropriate for those with an expected prognosis of less than this. Our data suggest that, for many patients, this may have been the reason for lack of 3-monthly MRI scanning and the median survival of patients

who had no scans at all and died was 152 days (ie <6 months). These patients will have had an expected prognosis of 6 months at the time of SRS but may have declined following treatment. It is also worth noting that some results may have been affected by the COVID-19 pandemic as routine visits to the hospital were limited for many patients during the study period.

Most patients referred for re-treatment with SRS were asymptomatic with disease progression detected on surveillance imaging. These patients were treated sooner than they would have been if a surveillance MRI had not taken place. We may therefore, have prevented the development of neurological symptoms and the need for admission and emergency treatment.

Our study had some limitations. We did not analyse the use of systemic therapies which may have affected the control of brain metastases and some of our patients would have been on clinical trials which mandate their own follow up and imaging schedule. It would also be useful to collect data on the performance status of our patients and whether any of them required admission and emergency treatment for neurological symptoms, including whole brain radiotherapy.

Our institution will continue to emphasise the advice for three-monthly brain MRI scans after SRS for those patients suitable for further SRS if PD is detected. It is worth noting that, for some patients, close surveillance may increase anxiety and lower their quality of life. For other patients, the opposite may be true. We routinely discuss this with patients at the end-of-treatment clinic visit and in a written summary, which is sent to the referring clinician. We also plan to arrange educational sessions to primary oncology teams to help increase awareness of the potential benefit of surveillance MRIs after SRS.

Prospective research in larger patient cohorts is required to assess the clinical benefit of surveillance after SRS and this is currently underway in the SAFER study. It is necessary to ascertain whether earlier detection has an impact on overall survival, symptom-free survival, or quality of life. Patients treated for brain metastases comprise a heterogeneous population. Therefore, more research to identify prognostic factors for intra-cranial progression would ideally result in tailored surveillance schedules for patients. This would help to provide stronger recommendations to clinicians.

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