

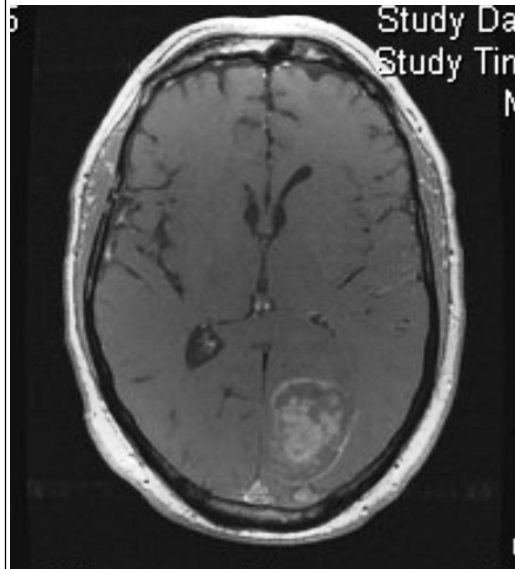
Introduction

Stereotactic radiosurgery (SRS) has been shown to be effective for most brain metastases less than 3 cm diameter (approximately 15cc). Larger metastases are well managed with surgery followed by adjuvant radiation or SRS. Patients with large metastases, who are not surgical candidates, have had few options. We looked at lesions greater than 20cc volume treated in the last 10 years with SRS for safety, efficacy and survival.

Methods

Between 2003 and 2010, we treated 17 patients with solid metastases over 20 cc's using SRS alone. We retrospectively analyzed demographics, diagnostic information, treatment parameters, and outcome data for this cohort of patients. Outcomes were measured in months survival post-treatment, improvement or stability of neurologic function and size of tumor and peritumoral edema. A Kaplan-Meier curve was constructed to look at survival. MRI images were used to measure volumes of tumor treated as well as edema present. Tumor and edema volumes were graded as improved (decreased by 10%), stable (unchanged) or worsened (increased by 10%).

Figure 1 - Large Brain Metastasis



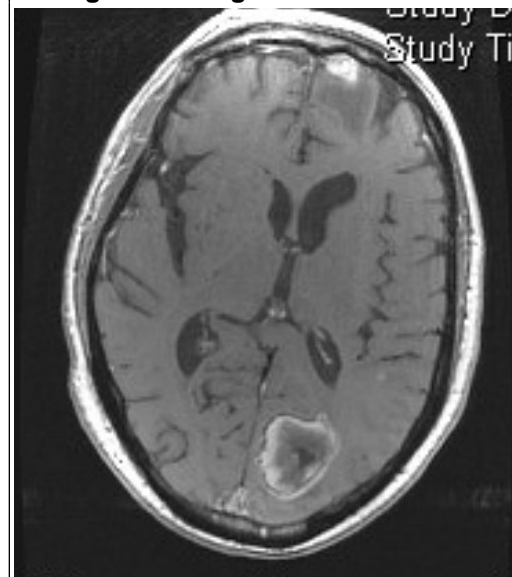
Largest brain metastasis pre-SRS treatment

Results

There were 14 men and 3 women aged 35 to 94 (median 64). Lesion volumes ranged from 20.4 to 56.7 cc (median 23.8cc). Lesion diameter ranged from 3.7 to 8.3 cm (median 4.4cm). Pathologies included melanoma (4), lung (2), renal (2), prostate (2), embryonal carcinoma (1), neuroendocrine (1), colon(1), squamous cell carcinoma (1), adenoid cystic carcinoma (1), teratocarcinoma (1), and unknown primary (1). Survival varied from 3 days to 18 months (median 4months). All patients have since died.

Figures one and two show a case example of the largest brain metastasis treated with SRS in this series.

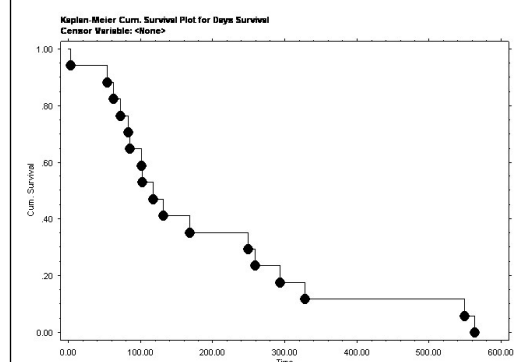
Figure 2 - Large brain metastasis



Largest brain metastasis post-SRS treatment

Twelve patients had follow up imaging available for analysis. Five patients were noted to have an increase in tumor size (42%) or tumoral edema (n=5, 42%). Two of these required craniotomy (12%). Two patients had stable tumor size (17%) and five showed improvement in tumor size and neurologic function (42%). Two patients suffered hemorrhages after treatment (one with embryonal carcinoma and one with renal cell carcinoma). Neither hemorrhage could be directly attributed to treatment (one distant lesion and one treated lesion several months following treatment). Five patients had no post-treatment imaging or were lost to follow-up. There were no treatment related complications or deaths.

Figure 3 - Kaplan Meier Curve



Kaplan-Meier survival curve showing patient survival in days following SRS treatment for large metastases

Conclusions

Some metastases larger than 20 cc can be safely treated with SRS alone. Outcomes were best for those with a radiosensitive lesion, those with locally invasive lesions, and those with high pretreatment Karnofsky scores. Efficacy of treatment as determined by stability in size or decrease in size of the tumor is not possible to determine given this small population. A certain number of patients may still go on to require craniotomy or succumb to neurologic death despite treatment. Further investigation is warranted.

References

Yang, H., H. et al (2011). What factors predict the response of larger brain metastases to radiosurgery? *Neurosurgery*. 68:682-690.
 Muacevic, A. Et al (2010). Feasibility, safety and outcome of frameless image-guided robotic radiosurgery for brain metastases. *J Neurooncology*. 97:267-274.