

GAMMA KNIFE RADIOSURGERY WITH OPTIMIZED MARGIN DOSE DELIVERY FOR MULTIPLE BRAIN LESIONS: SURVIVAL FOR 4 – 10 LESIONS IS COMPARABLE TO THAT FOR 1 – 3 LESIONS - PALLIATION IS EXCELLENT

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Purpose: A comparison of mean survival of patients with 4 – 10 metastatic brain lesions with that for 1 – 3 lesions treated with Gamma Knife radiosurgery with optimized margin dose delivery . Is there survival better than the historical 4-6 months for patients treated with whole brain radiotherapy?

Sixty-two patients with brain metastases were treated in this fashion between 2002 and 2005. The male to female ratio was balanced, ages ranged from 28 to 80 years, and Karnofsky Performance Status between 70-90%. They were divided into two groups, of 1-3 and 4-10 lesions.

Melanoma patients were 29% [18/62]; 24% [15/62] breast; 37% [23/62] non-small cell Ca of lung; others Colon Ca, unknown primary at 8% [5/62]; and Renal cell Ca at 3.2% [1/62].

Methods& Materials: A review of treatment plans for 650 patients revealed that early progression of a treated lesion was sensitive to placement of the 50% line. Reports of invasive tumor failure post radiosurgery indicates an 80-90% marginal failure. Systematic and gamma knife physical precision errors, beam profile, MRI image transfer limitations, and tumor infiltration beyond the margin are minimized by an optimized 50% line placement at + 3 to 4 mm beyond visualized tumor.

All the patients received radiosurgery +/- whole brain XRT at 250 cGy per fraction for a total of 3750 cGy, treating at 5 days a week. Gamma knife optimized dose at the 50% line ranged between 16-20Gy. A high 20 Gy at 50% line, invariably on spectroscopy leads to an excellent tumor kill centrally, but a high marginal tumor failure rate is common if margin dose is not optimized.

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Statistics:

The mean survival of patients with 1-3 lesions was 16.6 months and for 4-10 lesions 15.4 months. The difference in overall survival is not statistically significant (P = 0.86, log-rank test). This is evident from the Kaplan-Meier graph.

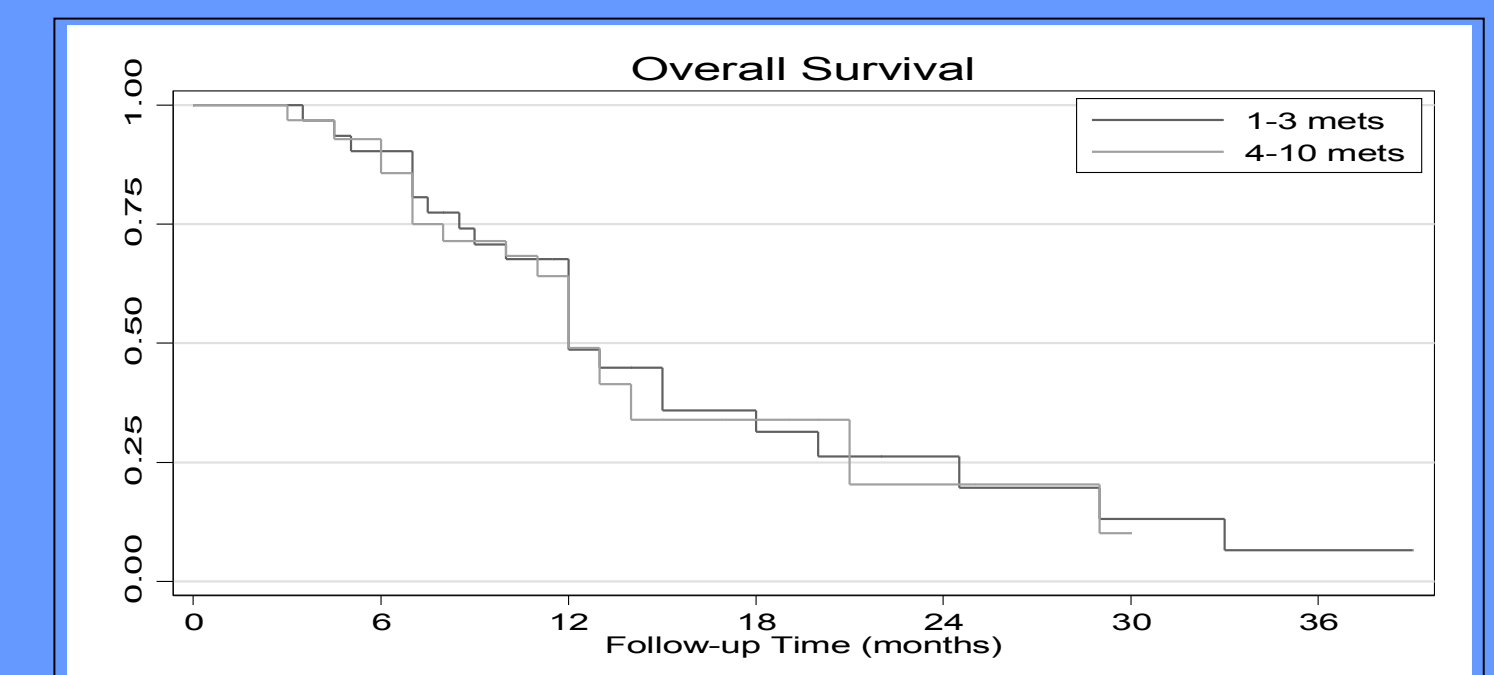
Results:

At the time of writing, with a follow up of 40 months, the mean survival for 1-3 lesions is 16.6 months and for 4-10 lesions at 15.4 months. When melanoma patients (29% of total) were included, mean survival dropped to 13.5 months for 1-3 lesions and 13.9 months for 4-10 lesions. The mean survival has not been reached as 26.2% of the patients are still alive. 24.6% have survived greater than 20 months.

Gamma Knife Survival

Author	Method	Metastases Survival in Months	
		1 – 3 Lesions	4 – 10 Lesions
RTOG 9508 (2004)	GK ± WBXRT	6.5 to 4.9	
Yamamoto, et. al. (2004)	GK		5.5
Ratna Datta (2004)	WBXRT	7.9	
Young Soo Kim	GK±WBXRT	8.0	
Kondziola, et. al (1999)	WBXRT	7.5	
Kondziola, et. al. (1999)	GK + WBXRT	11.0	
Aoyama, et. al. (2006)	GK + WBXRT	7.5	
Fregene, et. al. (2006)	GK + WBXRT	13.5 *	13.9 *
		16.6	15.4

* Melanoma inclusive



Conclusion:

Patients with multiple brain metastases 4-10 lesions treated with optimized margin dose do benefit significantly in terms of improved survival with excellent neurological symptoms palliation, comparable to that for 1-3 brain lesions similarly treated.

More studies including advanced spectroscopy aimed at better tumor margin delineation will lead to improved survival.

