



Gamma-knife Radiosurgery with or without Whole Brain Irradiation for Brain Metastases

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INTRODUCTION

Brain metastases are common, affecting up to 40 % of all cancer patients. The overall median survival is only 4 months after whole-brain radiotherapy (WBRT). Focal treatment of brain metastases with surgical resection has been shown to improve local control and to prolong survival, especially combined with WBRT. Radiosurgery (RS) offers an effective method for achieving sustained local control and prolonging survival. Compared to surgery in the management of brain metastasis, RS is less invasive and is capable of treating surgically inaccessible lesions. The purpose of this study is to evaluate the outcomes and prognostic factors in patients with brain metastasis treated by RS.

METHODS & MATERIALS

Between May 1993 and April 2005, all patients with metastatic brain disease treated with Gamma Knife® RS (GKRS) at Taipei Veterans General Hospital were reviewed, including a total of 577 metastatic lesions treated in 205 GKRS sessions in 187 patients. Out of 187 patients, 22 patients were excluded because of prior resection of brain metastases; 26 patients were excluded because the interval between up-front WBRT and RS > 3 months; and 1 patient was excluded for lost to follow up. Of the 138 evaluable patients (74 men and 64 women, median age 64 years, range 31-87), 113 patients (272 lesions) received RS alone initially and 25 patients (63 lesions) received WBRT + RS. The median prescribed RS dose was 16.5 Gy (range, 10-27); the median tumor volume was 5.74 ml (range, 0.08-33.5); and median number of isocenters was 10 (range 1-24). Median follow-up time was 17.5 months for patients still alive. Survival was estimated using Kaplan-Meier method. Univariate and multivariate analyses were performed using the Cox proportional hazards model. Statistical analyses were calculated with commercial statistical software package (Stata 8.0 for Windows).

RESULTS

Table 1. Patient characteristics

	RS alone (n= 113)	RS + WBRT (n= 25)
Age, range (median) (years)	36-87 (64)	39-81 (65)
< 65 years	58 (51%)	12 (48%)
≥ 65 years	55 (49%)	13 (52%)
Performance status		
KPS = 70 - 80	66 (58%)	16 (64%)
KPS = 90 - 100	47 (42%)	9 (36%)
RPA class		
RPA class 1	28 (25%)	4 (16%)
RPA class 2	85 (75%)	21 (84%)
Primary site		
Lung	56 (49%)	14 (56%)
Breast	10 (9%)	3 (12%)
Colorectal	9 (8%)	2 (8%)
Other	28 (25%)	3 (12%)
Unknown	10 (9%)	3 (12%)
Number of brain metastases		
1	53 (47%)	13 (52%)
2	27 (24%)	6 (24%)
3	13 (11%)	2 (8%)
≥ 4	20 (18%)	4 (16%)

KPS = Karnofsky performance score; RPA = Recursive partitioning analysis

Table 2. Survival results in subgroups

Parameters	Median survival (months)	1-year survival rate (95 % CI)
Age		
< 65 years	14.9	57% (44-68%)
≥ 65 years	6.4	32% (21-43%)
RPA class		
RPA class 1	16.2	69% (47-83%)
RPA class 2	8.7	39% (29-49%)
Primary site		
Lung	12.1	51% (39-62%)
Breast	12.9	60% (29-81%)
Colorectal	7	30% (5-60%)
Other/ unknown	6.4	31% (18-45%)
Number of brain metastases		
1 (n=66)	12.1	51% (38-62%)
2 (n=33)	6.6	39% (22-55%)
3 (n=33)	6.8	31% (8-57%)
≥ 4 (n=33)	6.4	40% (19-60%)

KPS = Karnofsky performance score; RPA = Recursive partitioning analysis

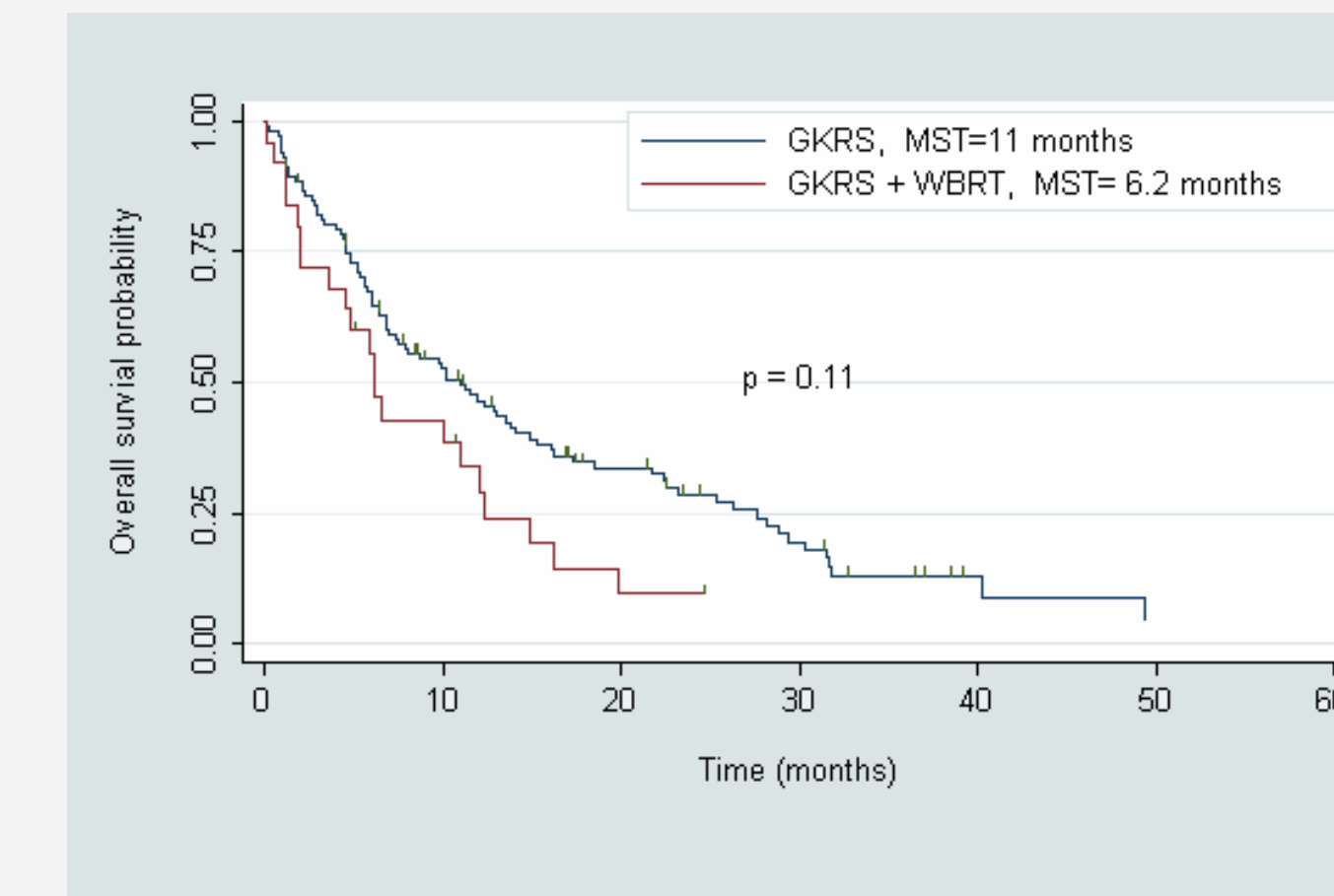


Figure 1. Overall survival, GKRS with or without WBRT.

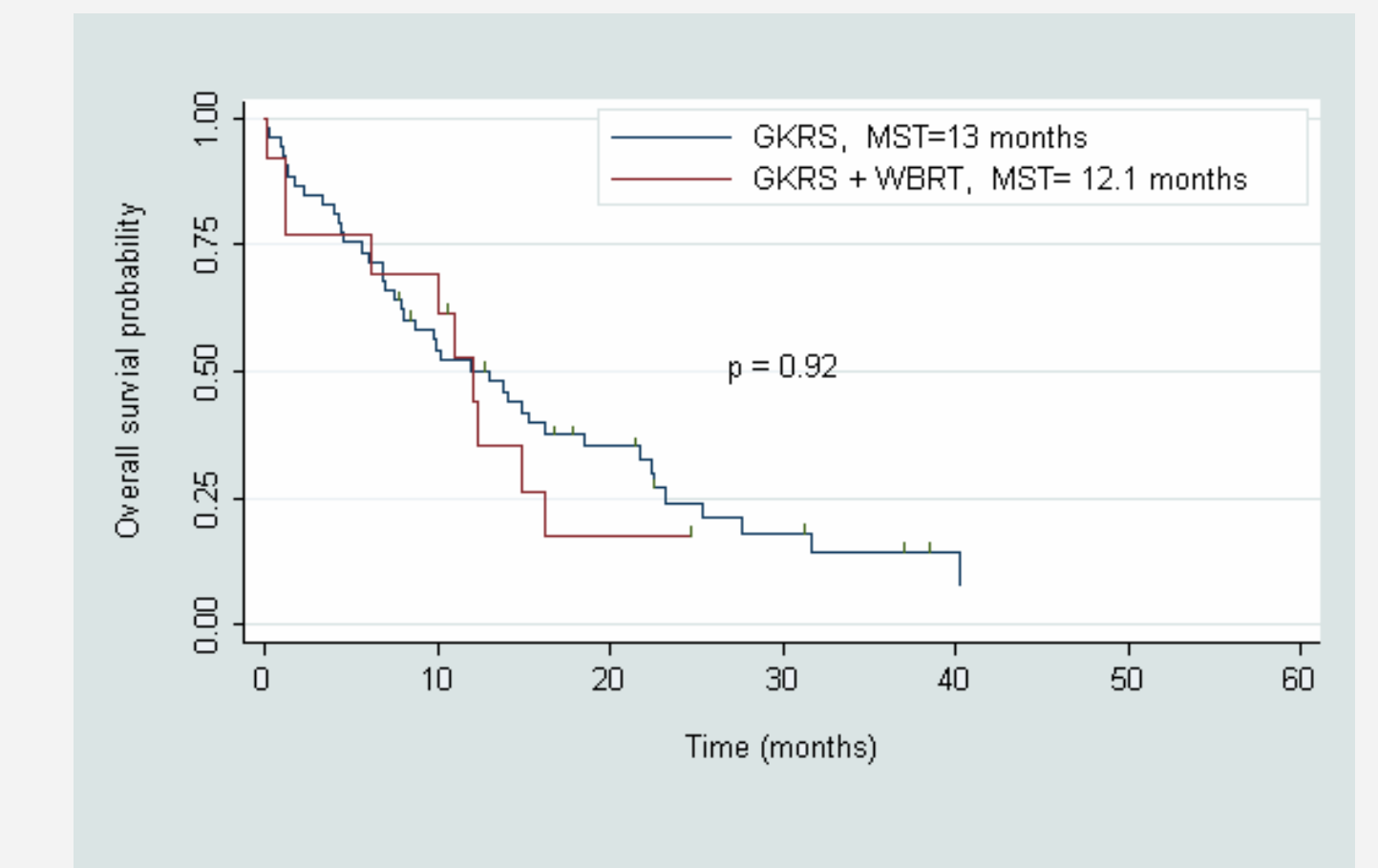


Figure 2. Survival in patients with single metastasis, GKRS with or without WBRT.

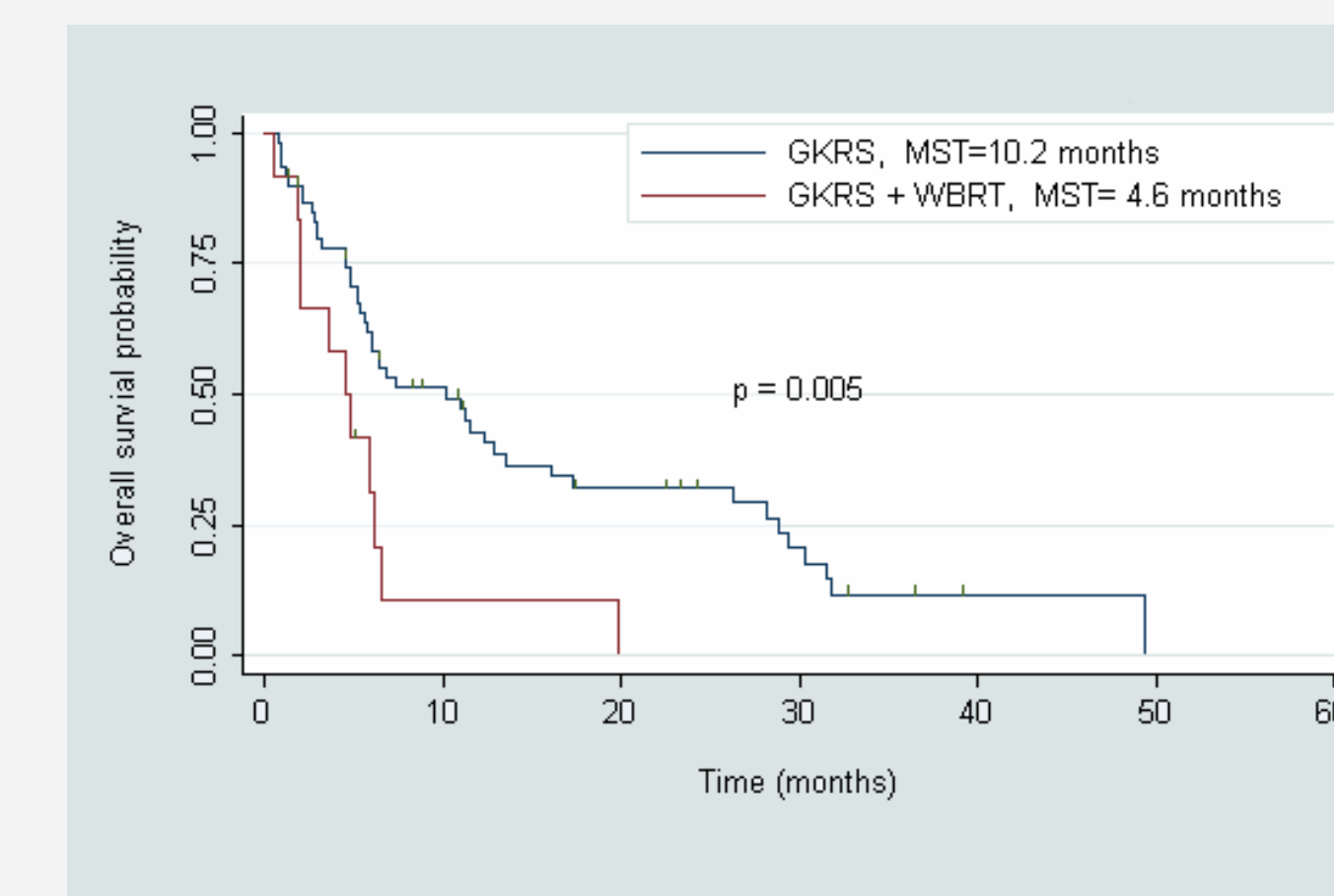


Figure 3. Survival in patients with multiple metastases,

GKRS with or without WBRT.

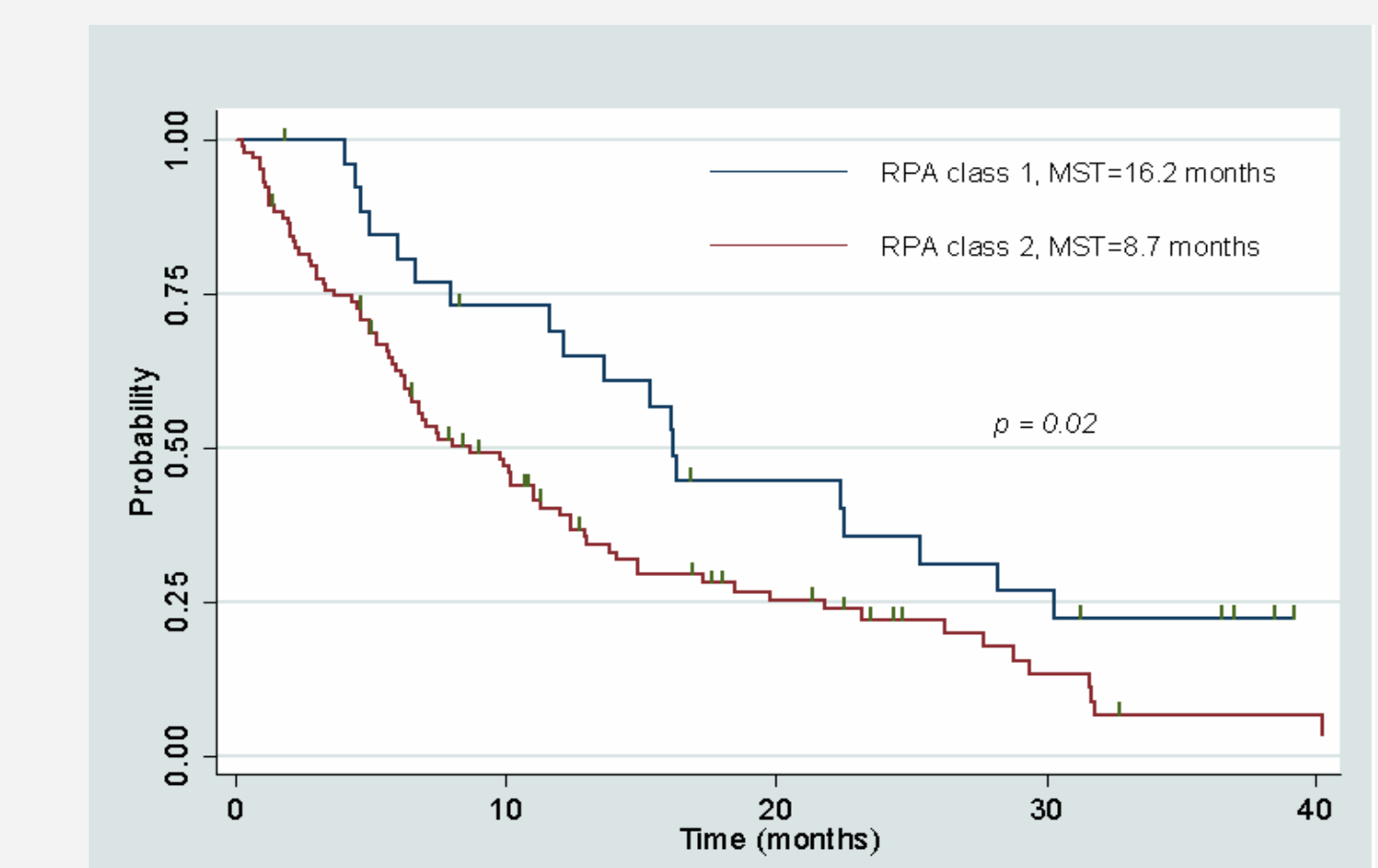


Figure 4. Overall survival by RPA class.

CONCLUSION

Our results, with a median survival of 10.2 months, are comparable to the historical non-randomized radiosurgical studies. The survival data for RPA class I and class II patients in our study are better than the reported results from RTOG 95-08. It implies that careful selection of patients play a major role in the outstanding results of radiosurgery compared to conventional radiotherapy. Additional WBRT does not improve the duration of survival in our patient population. For palliation purpose, either RS alone or WBRT alone is appropriate treatment modality for selected patients with 4 or less brain metastases and RTOG class II patients. Aggressive RS + WBRT should be preserved for RTOG class I patients.