



Gamma Knife Radiosurgery for Metastases >= 2cm: Outcomes and Prognostic Factors

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Introduction

Gamma Knife radiosurgery(GK-RS) has been recognized as an effective modality for treatment of brain metastases(BM). We are reporting our series of patients with large brain metastases, >2 cm in diameter, who received GK-RS according to RTOG90-05 dosing as a part of their treatment, focusing on factors affecting the progression-free survival(PFS), overall survival(OS) and radiation necrosis(RN).

Methods

273 patients with >2 cm BM were treated with GK-RS at our institution (2000-2012) and their data are maintained in as IRB-approved database. Multivariate analysis was used to determine the prognostic factors affecting the PFS, OS and RN.

Results

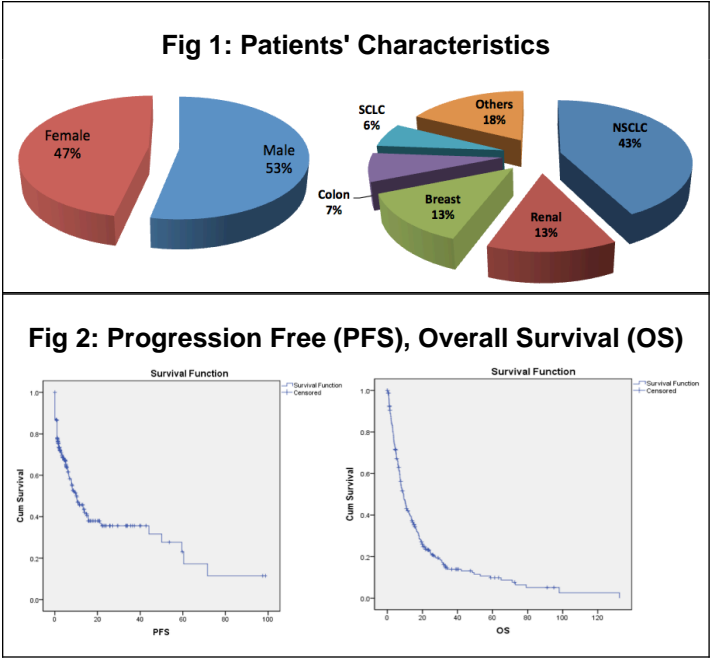


Table 1: Factors significantly impacting the progression free survival		
Factor	Multivariable	
	Hazard Ratio (95% C.I.)	p-value
Extracranial Mets (Yes vs No)	2.16 (1.55-3.00)	<.0001
KPS (<70 vs >70)	1.68 (1.25-2.63)	.001
Prior WBRT (Yes vs No)	1.47 (1.08-2.00)	.02

Table 2: Factors significantly impacting the overall survival		
Factor	Multivariable	
	Hazard Ratio (95% C.I.)	p-value
Extracranial Mets (Yes vs No)	2.24 (1.54-3.24)	<.0001
KPS (<70 vs >70)	1.65 (1.18-2.29)	.003
Gender (Male vs Female)	1.43 (1.02-1.99)	.04
Interval from Primary to Brain Mets (<6 vs >6 months)	1.39 (1.00-1.95)	.05

Estimated 1-yr local control in MRI was 83±3% (using uncensored data)
Median PFS and OS was 7.1 m and 9.3 m (Figure 2).

Factors that significantly decreased the PFS included:

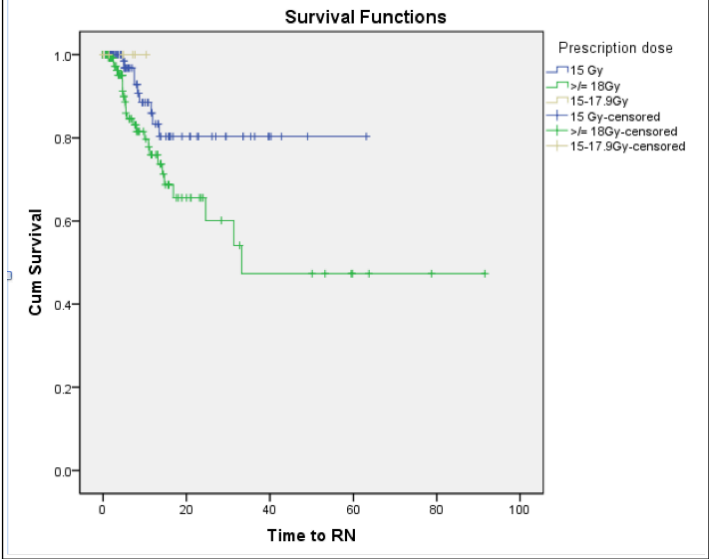
- Presence of extracranial (ECM) metastases pre GK-RS
- Karnofsky Performance Score (KPS) =70
- History of whole brain radiotherapy (Table 1)

Factors adversely affecting the OS included:

- Presence of ECM
 - KPS=70
 - =6 m interval between the diagnosis of the primary and the appearance of BM (Table 2)
- Factor affecting risk of RN:
- Maximum diameter of =3cm/15Gy (Figure 3)

Primary histology or pre-treatment surgery did not affect any of the studied outcomes

Fig 3: Radiation necrosis



Conclusions

- Characterizing factors affecting patient outcomes will allow more effective targeted treatments for patients with BM
- GK-RS is a viable treatment option for patients with large BM and results in a 1-yr local control rate of 83%
- Low KPS, concurrent ECM and early appearance of BM (= 6m) were poor prognostic factors for PFS and OS
- RN was highest in BM treated with higher doses of radiation (18 Gy vs. 15 Gy)
- Future prospective studies to determine appropriate patient selection for GK-RS in patients with extensive systemic disease burden is needed

Learning Objectives

Various prognostic factors that are governing the outcome in patients with brain metastasis treated by Gamma knife Radiosurgery.