Resection for Locally Recurrent Brain Metastasis by Propensity Score Matching in A Retrospective Cohort Study

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Importance

Locally recurrent brain metastases (LRBM) in patients initially treated by neurosurgical resection (NSR) or stereotactic radiosurgery (SRS) can be managed by resection; yet, comparative data on resection after prior treatments by NSR or SRS are scarce.

Objective

Our objective was to assess overall survival (OS) and progression free survival (PFS) of resection in LRBM participants who were previously managed by NSR or SRS.

Design, Setting, and Participants

The records of LRBM adult patients treated with resection at the Brigham and Women's Hospital between 2007 and 2017 were retrospectively reviewed under Institutional Review Board approval. Patients were included if they had previously received either NSR or SRS for brain metastases.

Main Outcomes and Measures

The primary endpoint of the study was overall survival (OS) and the secondary endpoint was progression-free survival (PFS). A propensity score was obtained from an unconditional logistic regression that included all identified prognostic covariates and additional established covariates from the literature. Estimation of causal treatment effects involved the use of a multivariable technique in which the group previously treated with NSR were matched to patients previously with treated with SRS on a one-to-one basis (1:1) by the propensity score to balance both groups.

Results

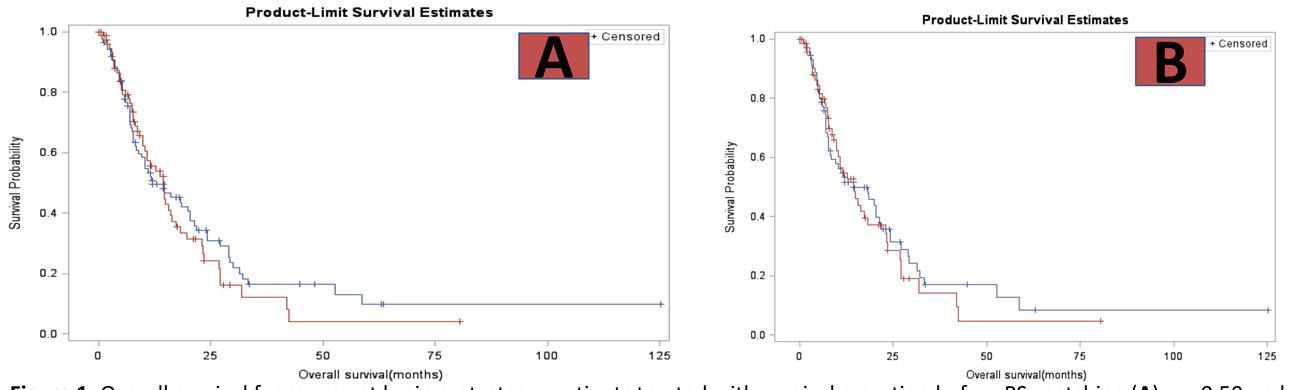

Figure 1. Overall survival for recurrent brain metastases patients treated with surgical resection before PS-matching (**A**), p= 0.50 and after PS-matching (**B**), p=0.34. NSR SRS

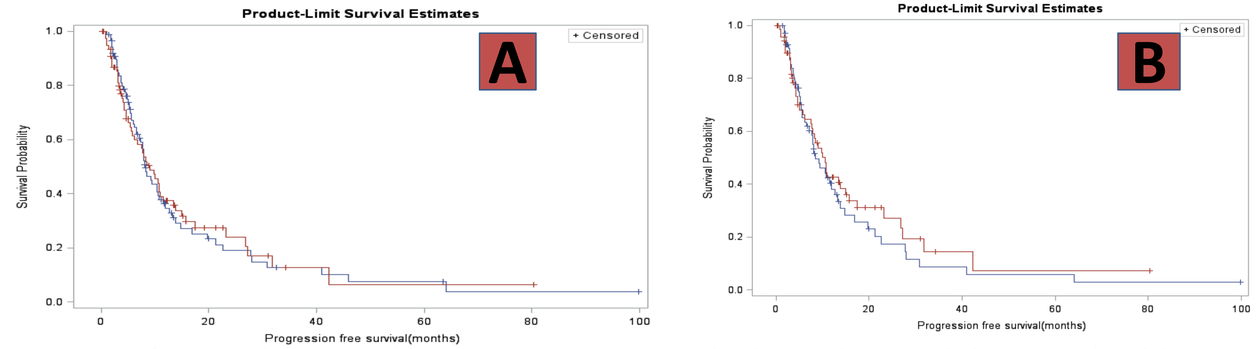

Figure 2. Progression free survival in recurrent brain metastases patients treated with surgical resection before PS-matching (**A**), p=0.90 and after PS-matching (**B**), p=0.94.

The electronic medical records search yielded 1069 resections and 168 of these met the inclusion criteria for this study. The matching on prognostic factors (age at recurrence, size of tumors, sex, performance status) produced 146 matched pairs (73 NSR vs 73 SRS). Median overall survival was 16.2 months in NSR vs 14.4 months in SRS (p=0.34) and median PFS was 8.4 months in NSR vs 9.6months in SRS (p=0.94). The standardized difference for the identified predictive factors for matching were not significantly different except for performance status which was 0.86% above the chosen absolute value of <10%.

Tables Hazard ratios for overall survival and progression free survival across the multivariable Cox regression models comparing prior neurosurgical resection versus stereotactic radiosurgery.

Model	Multivariable proportional hazards survival analysis			
	HR	95% CI	SE	P
PS 1:1 matched	2.18	1.18-4.01	0.31	0.01
PS 1:1 matched + 3 covariates[a]	2.34	0.92-5.93	0.47	0.07
Full cohort + 3 covariates, adjusting for the PS	2.39	0.97-5.80	0.46	0.06

Model	Multivariable proportional hazards survival analysis			
	HR	95% CI	SE	P
PS 1:1 matched	1.41	0.78-2.56	0.30	0.26
PS 1:1 matched + 3 covariates[a]	0.99	0.37-2.67	0.51	0.05
Full cohort + 3 covariates, adjusting for the PS	1.45	0.56-3.78	0.49	0.45

HR -Hazard ratio; CI- Confidence interval; SE- Standard error; PS- Propensity score; [a]covariates added to the model are number of lesions, operation number, adjuvant therapy

Conclusion and relevance

Resection is a beneficial treatment for LRBM, and the survival outcomes are comparable in patients already treated with either NSR or SRS. Individualized treatment is still important as patients present with unique baseline characteristics.