

Laser-interstitial Thermal Therapy versus Craniotomy for Treatment of Radiation Necrosis or Recurrent Tumor in Previously Irradiated Brain Metastases

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Introduction

Laser-interstitial thermal therapy (LITT) is gaining popularity as an alternative treatment to craniotomy for both radiation necrosis (RN) and re-growing tumor occurring after radiosurgery for brain metastases. However, there have been no studies to-date comparing the two options.

Methods

A single institution, single surgeon retrospective chart review was conducted of patients undergoing either LITT or craniotomy for a previously irradiated brain metastasis between February 2007 and September 2016. Data collected included basic demographics, pre- and postoperative steroid dosing and neurological outcomes, local progression-free survival (PFS), and overall survival (OS; defined from date of LITT/craniotomy). Categorical variables were analyzed with Fisher's exact tests and outcomes were analyzed with log-rank tests.

Results

Of 75 patients, 42 had pathology showing tumor (56%) and 33 (44%) showed radiation necrosis. Of patients with tumor, 26 underwent craniotomy and 16 LITT. For RN, 15 had craniotomy and 18 LITT. Across the four cohorts, there were were no significant differences in gender (45% male, 55% female), age at time of surgery (60 + / - 11)years), cancer type (melanoma, NSCLC, breast, other), tumor location, presence of active vs controlled systemic disease, and a history of prior WBRT, SRS, or surgery.

Overall, there was no significant difference between LITT and craniotomy groups in 30-day complication rates, the ability to come off steroids, or neurological outcomes. Compared to craniotomy, patients treated with LITT had significantly smaller lesions (4.1cm3 vs 8.1cm3, p=0.02), longer operation times (7.6 vs 4.5 hrs, p<0.001), and shorter length of hospitalization (3.1 vs 3.9 days, p=0.03). PFS (Figure 1) and OS (Figure 2) were similar for LITT versus craniotomy, respectively: % PFS-survival at 1-year = 72.2% versus 61.1%, % PFS-survival at 2years = 60.0% versus 61.1%, p=0.72; % OS-survival at 1year = 69.0% versus 69.3%, % OS-survival at 2-years = 56.6% versus 49.5%, p=0.90.

Patients treated for RN had significantly longer PFS (Figure 3) and OS (Figure 4) compared to those for tumor: % PFS-survival at 1-year = 87.4% versus 48.8%, % PFSsurvival at 2-years = 81.5% versus 44.7%, p<0.01; % OS -survival at 1-year = 83.5% versus 57.5%, % OS-survival at 2-years = 63.3% versus 43.5%, p<0.01.

There was no signficant relationship between PFS or OS when analyzing lesion location or cancer type. On subgroup analysis, patients undergoing craniotomy for RN had better OS than those undergoing LITT for RN or those with tumor regardless of local treatment option (p<0.01) (Figure 5).

Conclusions

LITT appears to be as efficacious as craniotomy in achieving desirable functional outcomes, the ability to wean off steroids, and for local control of a recurrent irradiated brain metastasis, regardless of RN or tumor pathology. Prospective studies are needed to confirm these findings and help determine if overall survival is improved by craniotomy in those with radiation necrosis.

Learning Objectives

1. Studies comparing laserinterstitial thermal therapy to standard craniotomy for both radiation necrosis and recurrent tumor after radiotherapy for brain metastasis are lacking. 2. Laser-interstitial thermal therapy may be as efficacious as craniotomy in symptom management, steroid weaning, and local control of previously irradiated metastatic tumors regardless of lesion pathology. 3. Craniotomy may be advantageous for overall survival in those with radiation necrosis, but further prospective studies are needed to confirm these findings.

