Laser Interstitial Thermal Therapy to the Posterior Fossa: Challenges and Nuances

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■ BACKGROUND: **Posterior fossa tumors are rare in adults and pose a challenge to treat due to the bony contour of the posterior fossa, complex anatomical structures including deep venous sinuses, and the proximity of the fourth ventricle and brain stem. We describe our experience with laser interstitial thermal therapy (LITT) for the management of brain metastases and radiation necrosis of the posterior fossa.**

■ METHODS: **We retrospectively analyzed 13 patients with metastases and radiation necrosis of the posterior fossa managed with LITT.**

■ RESULTS: **Thirteen patients with histopathologically confirmed radiation necrosis (n = 5) and metastases (n = 8) of the posterior fossa underwent LITT. The median preoperative tumor was 4.66 cm^3, and median postoperative ablation cavity volume was 6.29 cm^3. The median volume of the ablation cavity was decreased to 2.90 cm^3 at a 9-month follow-up. The median volume of peritumoral edema was 12.25 cm^3, which fell to a median of 5.77 cm^3 at 1-month follow-up. The median progression-free survival was 7 months (range, 3—14 months) and the mean overall survival was 40 months (range, 2—49 months) after LITT. There were no intraoperative complications. One patient experienced palsy of the seventh and eighth cranial nerves on follow-up, attributable to LITT.**

■ CONCLUSIONS: **Lesions of the posterior fossa are challenging to treat given their proximity to the dura and venous sinuses. Our findings demonstrate that LITT ablation may be a safe and feasible option for metastases and radiation necrosis of the posterior fossa. Larger studies are needed to confirm the efficacy of this approach.**

INTRODUCTION

Tumors of the posterior fossa in adults are most commonly caused by extracranial metastases.[1] Up to 20% of patients with brain metastases present with posterior fossa tumors, usually considered a marker of poor prognosis.[2-6] Tumors in this region can be challenging to treat because of the complex anatomy of the posterior fossa and adjacent critical structures, such as the brainstem and cranial nerves. The inherent challenges related to the location, coupled with higher rates of complications compared with supratentorial lesions, makes surgical management of this patient population challenging.[7]

Stereotactic radiosurgery (SRS) is another option to treat posterior fossa lesions, particularly those in deep-seated loci, without significant edema.[8] Although SRS has been shown to improve local control in these cases, radiation delivery for lesions adjacent to cerebrospinal fluid outflow tracts can precipitate hydrocephalus due to the mass effect from postradiation tissue swelling.[9] In addition, the use of SRS and surgical resection in this patient population has shown appreciable rates of recurrence and poses a risk for the development of radiation necrosis, with studies reporting rates of 5%—11% at 6-month follow-up.[10,11] Recurrent tumors and radiation necrosis of the

Key words
- Brain metastases
- Deep-seated tumor
- Laser interstitial thermal therapy
- Posterior fossa
- Radiation necrosis

Abbreviations and Acronyms
FLAIR: Fluid-attenuated inversion recovery
LITT: Laser interstitial thermal therapy
MRI: Magnetic resonance imaging
OS: Overall survival
PFS: Progression-free survival
SRS: Stereotactic radiosurgery
T1C+: T1-weighted postcontrast
WBRT: Whole-brain radiotherapy

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posterior fossa, especially following surgical resection or radiation, pose significant challenges to management. Therefore, there is a need for alternative local treatment options to reduce tumor burden and minimize complications.

Laser interstitial thermal therapy (LITT) has emerged as a minimally invasive technique for the treatment of primary brain tumors, metastases, and radiation necrosis.[12-14] Specifically, LITT has shown efficacy in the management of deep-seated lesions less amenable to resection by conventional surgical techniques.[15] The advent of magnetic resonance (MR) thermography for real-time observation of the extent of tissue ablation as well as stereotactic guidance of the delivery probe has made LITT a precise and potentially safe treatment for brain tumors and radiation necrosis alike.[16] Although some studies have shown LITT to be particularly efficacious for deep-seated lesions, there is little evidence to support the use of LITT in patients with brain metastases of the posterior fossa specifically.[17-19] Here we describe our experience and the challenges of using LITT for the management of posterior fossa lesions in a cohort of patients with brain metastases and radiation necrosis.

MATERIALS AND METHODS

Study Design, Setting, and Participants

This study was performed under the auspices of an Institutional Review Board–approved protocol in compliance with institutional regulations on the study of human subjects. A retrospective search of the Neurosurgery Department database from January 2014 to January 2018 identified 13 patients treated with LITT for posterior fossa metastases and radiation necrosis. A retrospective chart review was performed to collect demographic, clinical, radiologic, and pathological information. One patient (case 12) was selected for illustration of some of the challenges of LITT in the posterior fossa due to the precarious location of this tumor adjacent to the transverse venous sinus and tentorium cerebelli.

Operative Technique

All procedures were performed in an intraoperative magnetic resonance imaging (MRI) suite with a Siemens Espree 1.5-T magnet (Siemens, Berlin, Germany). A preoperative MRI was obtained to plan the trajectory of the ablation probe using Brainlab iPlan software (Brainlab, Munich, Germany). A cannulated bolt was then inserted in the patient's skull under imaging guidance along the planned trajectory using the VarioGuide system (Brainlab), followed by insertion of the pre-measured delivery probe. LITT procedures were performed by the senior authors with the Neuroblate system (Monteris, Winnipeg, Canada).

The details of our ablation technique have been described elsewhere.[20] The approach to ablation of lesions in the posterior fossa is different, however. Foremost, a larger incision is made (1 cm) for insertion of the cannulated bolt than is required for supratentorial lesions (3–4 mm), to allow for adequate retraction of the posterior cervical musculature before drilling. In addition, the contour of the posterior fossa provides little anchoring bone for insertion of the cannulated bolt, and thus the larger incision allows for easier perpendicular insertion of the bolt in the skull along the planned trajectory of the probe.

Study Variables

The following variables were collected from patient medical records: age, sex, primary tumor histology, date of LITT procedure, pre-LITT and post-LITT medical treatment (chemotherapy and radiation therapy), tumor volume pre-LITT, ablation volume immediately after LITT, post-LITT tumor volume on each follow-up MRI scan (usually every 2–3 months), local recurrence, and complications. Overall survival (OS) was defined as the time between the LITT procedure and date of death for deceased patients or the date of the last follow-up for patients alive at the end of follow-up. Progression-free survival (PFS) was defined as the time between the LITT procedure and the date of the first post-LITT local recurrence or the date of the last follow-up MRI for patients who did not develop recurrence at the last follow-up. Recurrence was defined by 2 independent neuroradiologists using the Response Assessment in Neuro-Oncology Brain Metastases working group criteria.[21]

Follow-Up, MRI, and Volumetric Analysis

All patients underwent brain MRI before the LITT procedure and follow-up imaging at regular intervals after treatment (usually every 2–3 months). Imaging sequences included T1-weighted precontrast and postcontrast (T1C+) and fluid-attenuated inversion recovery (FLAIR) MRI. The MRI data were exported to an iPlan workstation (Brainlab, Munich, Germany) from the electronic medical record. Using T1C+ MRI pre-LITT, immediately post-LITT, and at every follow-up, manual tumor segmentation was performed by a neuroradiologist to create a tridimensional volumetric measure. Similarly, manual segmentation of the edema was completed by a neuroradiologist, creating a tridimensional volumetric measure using FLAIR imaging data. On the preoperative scans, the tumor margin was the enhancing lesion. On the posttreatment scans, the margin was the ablation cavity. Single volume measurements of each lesion and associated edema were calculated and verified by the senior author. Five time periods—pre-LITT, immediately post-LITT, 0–30 days post-LITT, 30–60 days post-LITT, and 60–90 days post-LITT—were used to categorize the tumor and edema volumes for both the T1C+ and FLAIR images. The diagnosis of radiation necrosis was made by a neuroradiologist and a neurosurgeon based on follow-up imaging using our institution's advanced brain tumor imaging protocol.

Statistical Analysis and Data Synthesis

Continuous variables were summarized with median and range; categorical variables, with frequency and percentage. Summary statistics were calculated for all variables. The Kaplan–Meier method was used to estimate PFS and OS; survival curves were compared using a log-rank (Mantel–Cox) test. A Cox proportional hazards model with 95% confidence intervals was used to evaluate the difference in PFS between those patients who received post-LITT chemotherapy and those who did not. A P value <0.05 was considered significant for all analyses. Analyses were performed with SPSS 24 (IBM, Armonk, New York, USA). Graphs were constructed with the *ggplot2* (https://CRAN.R-project.org/web/packages/ggplot2/index.html) and *ggfortify* (https://CRAN.R-project.org/package=ggfortify) R packages.[22,23]

Table 1. Patient and Lesion Characteristics Following LITT

Case	Sex	Age (years)	Histology	Previous Treatment of Lesion*	Tumor Volume (cm^3)	Postoperative Cavity Volume (cm^3)	Cavity Volume at 1 month (cm^3)	Cavity Volume at 3 months (cm^3)	Cavity Volume at 6 months (cm^3)	Cavity Volume at 9 months (cm^3)	Cavity Volume at 12 months (cm^3)	Complications	Alive at Last Follow-Up?
1	F	69	Breast	SRS	6.72	11.6	N/A	N/A	N/A	N/A	N/A	None	No
2	F	51	RN	SRS	8.11	8.10	5.09	4.39	2.63	3.76	N/A	None	Yes
3	F	63	Breast	SRS	1.30	3.77	2.03	N/A	1.65	N/A	N/A	None	Yes
4	F	57	Breast	SRS	1.45	6.10	4.17	2.03	2.16	2.04	4.79	None	Yes
5	F	57	RN	SRS	1.61	3.48	4.42	0.84	0.28	N/A	N/A	None	Yes
6	F	31	RN	WBRT + SRS	8.81	13.40	16.97	14.33	6.53	4.82	N/A	None	Yes
7	F	60	RN	SRS	3.29	3.40	2.83	2.33	9.076	N/A	N/A	CN 7 and 8 palsy	Yes
8	F	69	NSCLC	SRS	4.66	10.56	9.55	11.12	11.12	N/A	N/A	None	No
9	M	79	SCLC	WBRT	6.81	7.81	N/A	6.44	N/A	N/A	N/A	None	No
10	F	56	Colon	Resection + SRS	7.52	8.34	6.97	9.81	14.55	N/A	N/A	None	Yes
11	F	36	RCC	SRS	0.33	6.29	10.55	3.93	N/A	N/A	N/A	None	Yes
12	F	58	Breast	Resection + SRS	5.16	3.90	3.68	3.05	2.36	1.95	1.43	None	Yes
13	F	68	RN	Resection + SRS	4.48	3.00	1.06	N/A	N/A	N/A	N/A	None	Yes

LITT, laser interstitial thermal therapy; F, female; SRS, stereotactic radiosurgery; N/A, not available; RN, radiation necrosis; WBRT, whole-brain radiotherapy; M, male; CN, cranial nerve; NSCLC, non—small cell lung carcinoma; SCLC, small cell lung carcinoma; RCC, renal cell carcinoma.

*All patients received systemic chemotherapy for primary malignancy before undergoing LITT.

Table 2. Previous Reports of LITT to the Posterior Fossa

Report	Number of Patients	Lesions Treated	Complications
Eliyas et al., 2014[34]	1	Metastasis	None
Chan et al., 2016[17]	1	RN	None
Dadey et al., 2016[18]	5	EF + BG	None
Borghei-Razavi et al., 2018[19]	8	RN + metastasis	Wound infection, hydrocephalus, CN 6 palsy
Present series	13	RN + metastasis	CN 7 and 8 palsy

LITT, laser interstitial thermal therapy; RN, radiation necrosis, EF, epileptogenic foci; BG, brainstem ganglioglioma; CN, cranial nerve.

RESULTS

Patient and lesion characteristics are summarized in Table 1. Thirteen patients with a median age of 58 years (range, 31–79 years) received LITT to the posterior fossa targeting 8 recurrent metastases (4 breast, 1 renal cell carcinoma, 1 colon cancer, 1 small cell lung carcinoma, and 1 non–small cell lung carcinoma) and 5 cases of radiation necrosis. Repeat LITT ablation of the lesion following recurrence was performed in 2 patients (cases 12 and 13). In all 5 cases of radiation necrosis, the patients had previous metastases of the posterior fossa (3 breast, 1 non–small cell lung carcinoma, 1 lung adenocarcinoma) and were treated with SRS. Of the 13 lesions, 8 (61.5%) were dura-based. The patients had a median preoperative Karnofsky Performance Status score of 90 (range, 70–100) and a median postoperative Karnofsky Performance Status score of 80 (range, 0–100) at the 3-month follow-up. The median time to discharge postoperatively was 2 days (range, 0–5 days). Eight patients received chemotherapy (4 with targeted therapy, 2 with systemic therapy, and 2 with combined systemic/targeted therapy), and all 13 patients received radiotherapy before LITT (11 with SRS, 1 with whole-brain radiation therapy, and 1 with both SRS and whole-brain radiation therapy). Of note, administration of adjuvant chemotherapy is determined on a case-by-case basis by a multidisciplinary team of medical oncologists, radiation oncologists, and neurosurgeons based on prognosis, status of systemic disease, and primary tumor histology. The median preoperative tumor volume was 4.66 cm^3 (range, 0.33–8.81 cm^3), and median 1-day postoperative ablation volume was 6.29 cm^3 (range, 3.0–13.40 cm^3). The median percent tumor coverage with LITT therapy was 96.2% (range, 77.52%–100%), with a median nonablated volume of 0.18 cm^3 (range, 0–1.03 cm^3). The median volume of the ablation cavity at 9-month follow-up was decreased to 2.9 cm^3 (n = 3; range, 1.95–4.82 cm^3) (Figure 1). The median peritumoral edema volume was calculated as 12.25 cm^3 (range, 0.74–41.76 cm^3). This median edema volume decreased to 5.77 cm^3 (range, 2.03–24.60 cm^3) at 1-month postoperative follow-up and then to 0.94 cm^3 (range, 0–2.87 cm^3) at 9-month follow-up (Figure 2). Ten of the 13 patients in the cohort (76.9%) were alive at the last follow-up. For the 3 patients who died, cause of death information was not available in the electronic medical record. The Kaplan–Meier estimate of mean OS was 40 months (range, 2–49 months). Local recurrence was observed in 9 patients (69.2%). The median PFS was 7 months (range, 3–14 months) after LITT (Figure 3). The median PFS for patients receiving chemotherapy after LITT (n = 2) and patients not receiving chemotherapy after LITT (n = 4) was 13.5 months and 5.0 months, respectively. This relationship was found to be statistically significant with univariate Cox regression analysis (P = 0.02; hazard ratio, 0.07; 95% confidence interval, 0.007–0.649) and a log-rank test (P = 0.003). Dura-based lesions were seen to have a similar time to

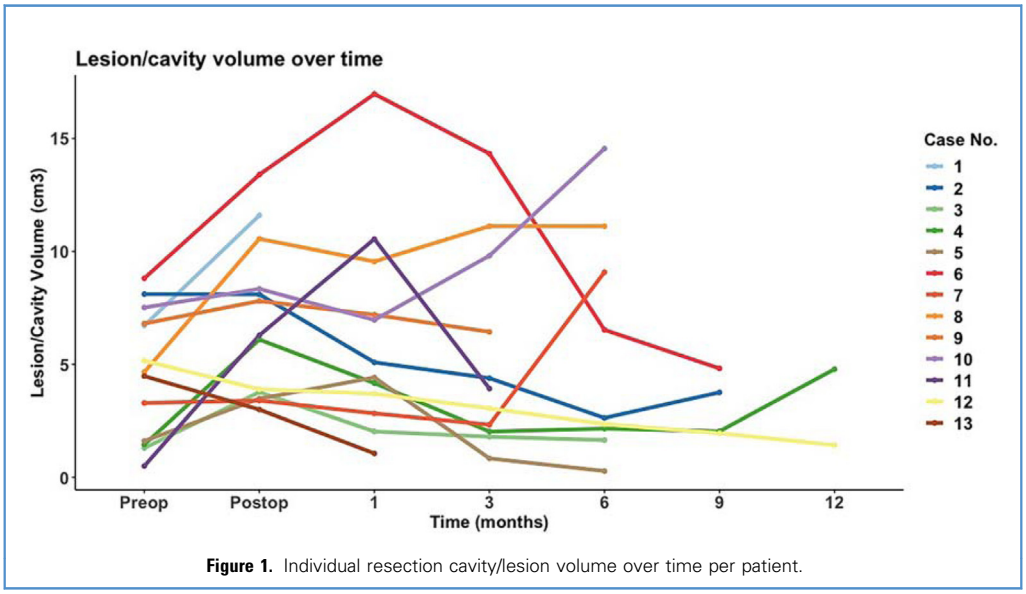

Figure 1. Individual resection cavity/lesion volume over time per patient.

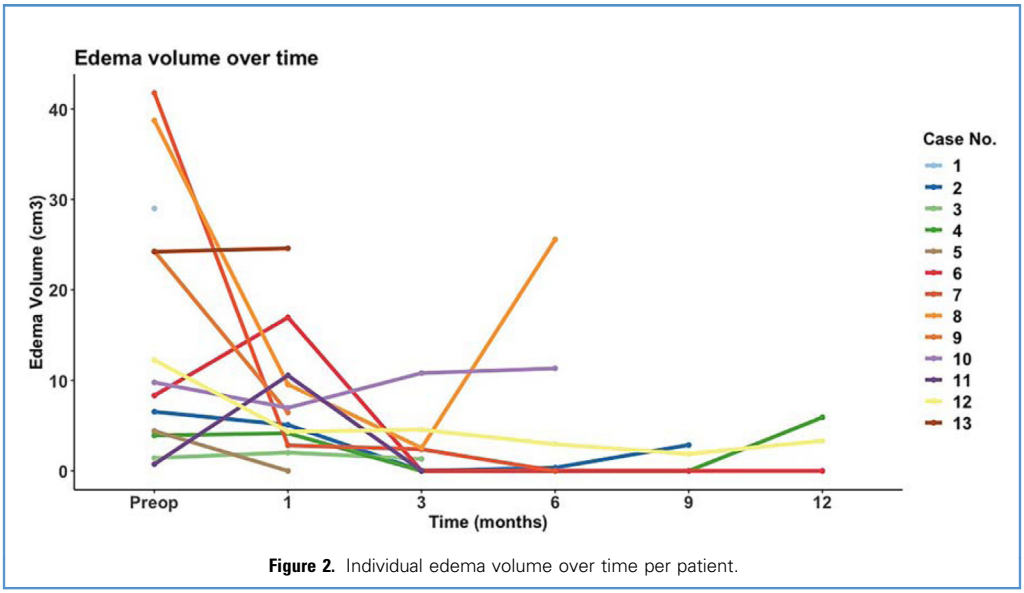

Figure 2. Individual edema volume over time per patient.

recurrence as non–dura-based lesions ($P = 0.3$, log-rank test). No intraoperative complications were observed. During the course of follow-up, 1 complication was observed; a patient with radiation necrosis following SRS for non–small cell carcinoma of the lung developed permanent, unilateral, seventh and eighth cranial nerve palsy thought to be due to the proximity of the cranial nerves to the tumor. Leptomeningeal disease was observed in 2 patients (15.4%) by the 12-month follow-up.

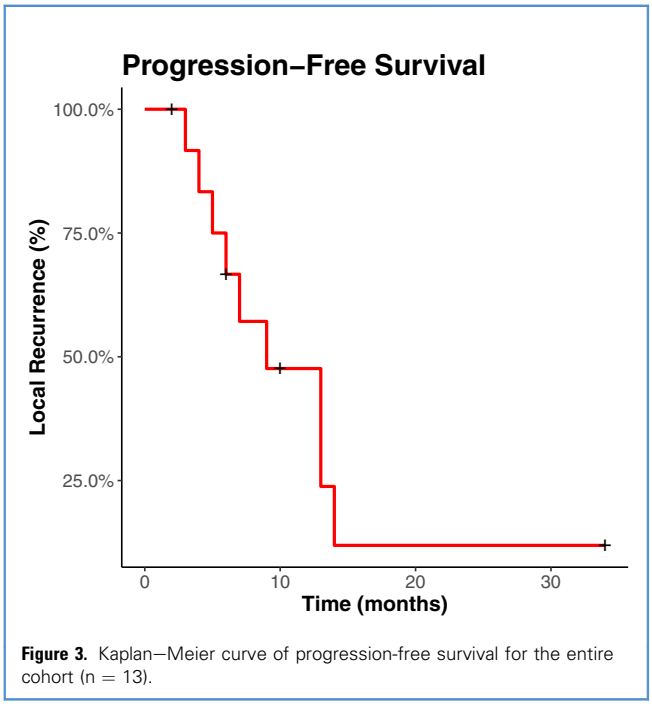

Figure 3. Kaplan–Meier curve of progression-free survival for the entire cohort (n = 13).

Case Illustration

Case 12. A 58-year-old woman with a history of suboccipital craniotomy for metastatic breast carcinoma presented to the neurosurgery clinic after progression of the lesion was discovered on follow-up imaging. She was originally diagnosed with invasive ductal carcinoma of the breast 12 years before the current presentation. After the discovery of a posterior fossa metastasis 4 years later, she underwent a subtotal resection, followed by multiple rounds of stereotactic radiosurgery and insertion of an Ommaya reservoir. At the current presentation, she had no complaints and a normal neurologic examination. Imaging at that time revealed interval progression of a right superolateral cerebellar metastasis adjacent to the transverse venous sinus and tentorium cerebelli with concern for both parenchymal and leptomeningeal components (Figure 4A and B). Additional surveillance imaging revealed no extracranial disease.

Given the proximity of the venous sinus and tentorium cerebelli, we did not believe that gross total resection of the progressive parenchymal lesion was possible. Instead, we felt that ablation of the entire enhancing margin was more feasible with a single trajectory and would reduce the tumor burden while minimizing potential complications. Although leptomeningeal disease is a contraindication to the LITT procedure, the leptomeningeal component was noted to be bulky on imaging, and cytopathological analysis of cerebrospinal fluid from the Ommaya reservoir did not identify any malignant cells, indicating stable disease.

Once patient consent was obtained, a single trajectory was mapped in Brainlab in the operating room, with care taken to avoid violating both the mastoid sinus and transverse and sigmoid sinuses traversing the tumor margin. In addition, the trajectory must provide for a well-anchored cannulated bolt, ideally perpendicular to the plane of the skull. Alignment and insertion of the LITT probe along this plotted trajectory using stereotactic

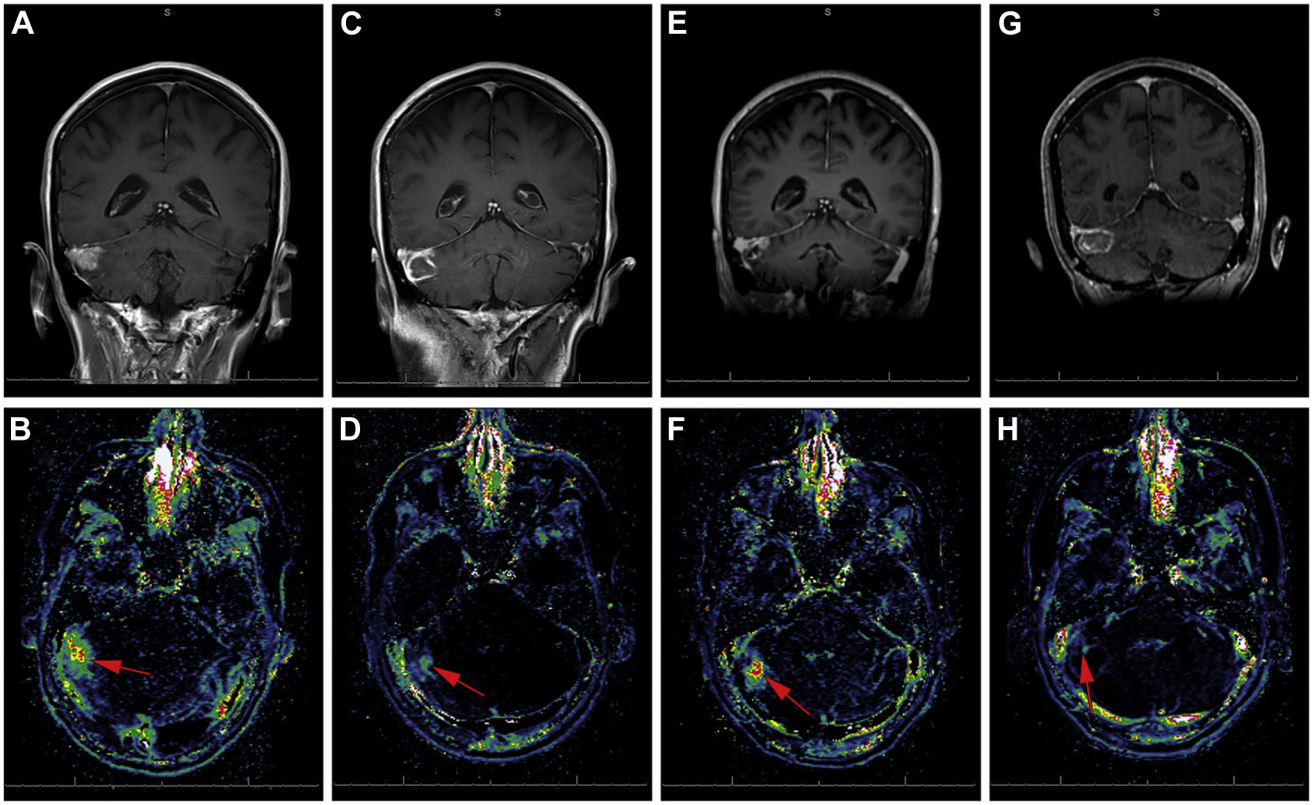

Figure 4. Magnetic resonance imaging (MRI) detailing the course of a patient (case 12) who underwent laser interstitial thermal therapy (LITT) twice for a metastatic lesion adjacent to the right transverse venous sinus and tentorium cerebelli. Coronal T1-weighted postcontrast (T1C+) MRI (**A**) and axial K^{trans} perfusion MRI (**B**) delineate the tumor pre-LITT. Coronal T1C+ MRI obtained at the 30-day follow-up (**C**) demonstrates the LITT ablation cavity, whereas axial K^{trans} perfusion MRI shows a marginal residual signature laterally, adjacent to the venous sinus (**D**). Repeat coronal T1C+ MRI performed 1 year later shows some increased contrast enhancement on the superior margins of the ablation cavity (**E**), whereas K^{trans} perfusion MRI shows an increased signature in the same region, consistent with tumor recurrence (**F**). T1C+ MRI (**G**) and K^{trans} perfusion MRI (**H**) obtained following repeat ablation of the recurrent tumor. The *red arrows* indicate the pretreatment and residual tumor volumes, respectively.

navigation in the Monteris Neuroblate software suite revealed a subvolume of the tumor by the treatment radius of the ablation probe (Figure 5). Although the lesion was targeted by the thermal damage radius, the adjacent sinus limited the extent of ablation. The patient tolerated the procedure without complication and was discharged on postoperative day 1 at neurologic baseline.

The subsequent follow-up course was unremarkable, although imaging at 1 month postoperatively revealed a stable ablation cavity (Figure 4C) with some residual tumor at the superolateral cavity margin, corresponding to an undertreated tumor subvolume (Figure 4D). These findings were stable on repeat imaging over the subsequent months. However, at 1 year after lesion ablation, a mild increase in size of the residual tumor in the same location (Figure 4E), coupled with increased signature from the region on K^{trans} perfusion MRI (Figure 4F), warranted surgical intervention. Consent was then obtained for repeat LITT ablation of the lesion to establish local control using a similar, single trajectory. Again, the patient tolerated the procedure without complication and was discharged on the first postoperative day. One-month follow-up imaging revealed a stable ablation cavity with no residual tumor on T1C+ MRI (Figure 4G) and no signature in the region on K^{trans} perfusion MRI (Figure 4H). At her most recent follow-up, she was neurologically intact with no complaints.

Of note, treating this lesion was particularly challenging due to the proximity of the transverse sinus, which complicated trajectory planning. Ultimately, a postauricular approach was selected that provided an adequate angle for anchoring of the cannulated bolt that provided direct access to the lesion without violating the adjacent sigmoid or transverse sinuses. Although the subvolume was thought to be adequately ablated, we attempted to minimize ablation of the portion of the lesion abutting the transverse sinus.

DISCUSSION

Taken together, the findings of this study suggest that LITT may be an effective therapy for managing brain metastases and radiation necrosis in the posterior fossa. Specifically, the OS of the patients in this cohort was comparable to that of patients who

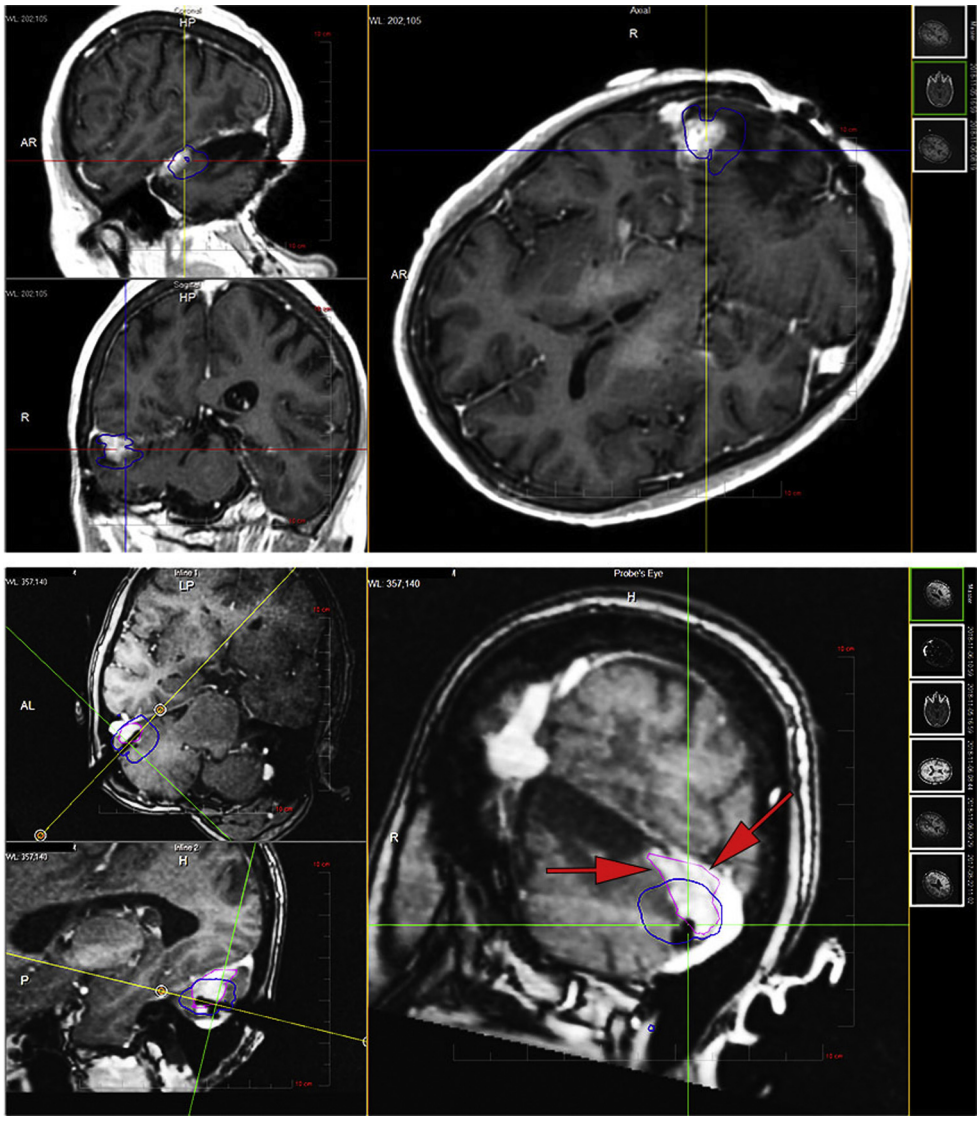

Figure 5. Screenshots of the Monteris Neuroblate software intraoperatively for a metastatic lesion adjacent to the transverse venous sinus. Probe alignment is planned with a 3-plane view of the lesion (axial, coronal, and sagittal) (*top*). Insertion of the probe is subsequently performed based on the trajectory delineated in Brainlab (*bottom*). The blue line circumscribes the thermal damage threshold (TDT) line radius for LITT ablation, and the pink line outlines the tumor. The volume of tumor (*pink*) not covered by the superimposed TDT lines (*blue*) is delineated by the *red arrows*.

undergo standard resection, but with a significantly lower rate of intraoperative complications. No patients experienced intraoperative morbidity or mortality. Although there is limited penetration of the blood-brain barrier by systemically delivered chemotherapeutic agents, our statistical analysis revealed a significant association between the receipt of adjuvant chemotherapy (targeted and systemic) after LITT and a longer time to local progression on Cox univariate analysis, a relationship that has been confirmed by a larger cohort study at our institution from which our series of patients was extracted (currently in press). It is possible that this is secondary to hyperthermic disruption of the blood-brain barrier by LITT, similar to the mechanism described by Leuthardt et al.[24] that may enhance the delivery of chemotherapeutic agents to the central nervous system. This finding suggests that the use of chemotherapy in conjunction with LITT may be a useful therapeutic option for the treatment of these lesions. Although the association was statistically significant, our sample size is small, and additional well-powered studies are needed before treatment recommendations can be established.

Our experience also illustrates many of the challenges involved in applying LITT to this precarious anatomic region. The proximity of the dural venous sinuses, the brain stem, and fourth ventricle calls for careful trajectory planning to provide adequate ablation coverage. Thus, in the patients in our series, some lesions were not amenable to complete ablation. Notably, in our case illustration (case 12), the metastasis was bordered by the transverse venous sinus laterally and the tentorium cerebelli superiorly, preventing adequate coverage of the entire tumor volume by the LITT thermal damage threshold lines. This untreated subvolume of the tumor was observed to recur, requiring additional operative intervention.

Although LITT provides a minimally invasive technique for reducing tumor burden in patients with deep-seated intracranial metastases, the anatomic constraints of the posterior fossa may hinder adequate laser ablation. Thus, we recommend a careful assessment of the achievable extent of ablation, particularly by evaluating feasible trajectories and proximity to critical neuroanatomic structures, associated perioperative risks, and potential benefits when considering LITT for this particular patient population.

Although surgical resection has been established for posterior fossa lesions in pediatric patients and for adults with larger lesions, causing significant mass effect or hydrocephalus, there is a paucity of evidence supporting any particular management approach for general infratentorial metastatic disease.[25,26] The rate of complications for surgical resection in these patients based on current evidence is approximately 26%.[7,27] Despite this relatively high rate of complications, surgical management with or without adjuvant radiotherapy is generally pursued for larger lesions with severe mass effect or hydrocephalus.[7,28,29] For smaller lesions, with little or no mass effect, SRS is a viable option with proven efficacy in local control, with a local recurrence rate of 7.8% for posterior fossa brain metastases following SRS.[11,30] Nonetheless, its use is not devoid of complications, as in cases of radiation necrosis, and larger lesions $\geq$2.5 cm in diameter are less likely to respond to SRS, although improved efficacy with novel techniques are emerging.[31-33]

In 2014, Eliyas et al.[34] presented the first case in which LITT was used to treat lesions of the posterior fossa in adults, paving the way for additional research on the topic. Later, Chan et al.[17] described the management of posterior fossa radiation necrosis following radiotherapy for anaplastic astrocytoma. Dadey et al.[18] reported the results of the first case series for patients receiving LITT for epilepsy and brain tumors in the posterior fossa and mesiotemporal regions. Finally, Borghei-Razavi et al.[19] reported the results of the largest and most recent study to date on LITT for posterior fossa lesions in 8 patients with brain metastases, radiation necrosis, or primary malignancy (**Table 2**).

Our present study adds to the growing, albeit limited, evidence supporting LITT for treating posterior fossa lesions, specifically recurrent cerebral metastases. This is the largest study reported to date and the first to quantify the OS and PFS of these patients and the role of systemic chemotherapy following ablation. Although the numbers are limited, there seems to be a survival benefit in patients treated with LITT, especially those with no other viable surgical options. Furthermore, patients with both brain metastases and suspected radiation necrosis of the posterior fossa responded well to ablation therapy, indicating that LITT may be an appropriate option for managing both disease processes, as has been shown previously.[35] This is particularly important, because the imaging findings of both disease processes are ambiguous, and tissue biopsy is required to confirm the diagnosis. In light of these data, it is our experience that patients with radiation necrosis treated with LITT show lower rates of local recurrence as has been corroborated in the literature.[14] All patients had a short duration of hospital stay and were able to resume adjuvant treatments soon after LITT. Local recurrence occurred after the first treatment in 7 patients. In these patients, the tumor recurrence was adjacent to either the dura or the major venous sinuses, further underscoring the challenges with using LITT in the posterior fossa.[36] However, in these recurrences, repeat LITT is always a salvage option and buys additional valuable time for patients.

Limitations

The primarily limitations of this study are the small sample size and the retrospective nature of data collection. Although our results show LITT to be safe and effective, the benefits of LITT should be validated in larger studies. The significance of post-LITT chemotherapy in prolonging the time to local progression seen in our cohort may be confounded by the fact that many patients were not treated with aggressive systemic chemotherapy. Thus, additional studies examining this relationship in particular are needed before meaningful conclusions can be drawn.

CONCLUSIONS

Lesions of the posterior fossa are challenging because of their proximity to the dura, venous sinuses, and deep structures in the posterior fossa. Careful planning of the ablation probe trajectory can overcome some of these challenges. We have demonstrated that LITT is a potentially safe and effective approach to treating these complex lesions that are otherwise difficult to manage with minimal morbidity. We have also shown a modest survival advantage in this cohort of patients, suggesting that careful patient selection may help optimize outcomes.

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