

LASER INTERSTITIAL THERMAL THERAPY

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[Instructions for Use](#) ⓘ

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Related Medical Management Guideline
• Intrauterine Fetal Surgery

COVERAGE RATIONALE

Laser interstitial thermal therapy is unproven and not medically necessary for treating ANY condition or diagnosis due to insufficient evidence of efficacy.

APPLICABLE CODES

The following list(s) of procedure and/or diagnosis codes is provided for reference purposes only and may not be all inclusive. Listing of a code in this guideline does not imply that the service described by the code is a covered or non-covered health service. Benefit coverage for health services is determined by the member specific benefit plan document and applicable laws that may require coverage for a specific service. The inclusion of a code does not imply any right to reimbursement or guarantee claim payment. Other Policies and Guidelines may apply.

CPT Code	Description
19499	Unlisted procedure, breast
20999	Unlisted procedure, musculoskeletal system, general
27599	Unlisted procedure, femur or knee
32999	Unlisted procedure, lungs and pleura
53899	Unlisted procedure, urinary system
55899	Unlisted procedure, male genital system
64999	Unlisted procedure, nervous system

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DESCRIPTION OF SERVICES

Laser interstitial thermal therapy/thermotherapy (LITT) is an emerging treatment modality. The LITT treatment produces focal thermal ablation leading to lesion cyto-reduction through tissue coagulation, necrosis, and cellular apoptosis. Historically, laser ablation techniques have been limited by an inability to assess ablation progress and parenchymal temperature during the course of treatment. Advances in magnetic resonance imaging (MRI) capabilities have overcome these limitations, leading to the use of this technology for select conditions.

CLINICAL EVIDENCE

Bone Tumors

A 2019 ECRI report found limited evidence from case series that suggest LITT is safe and that symptoms were reduced in most patients at one-month to one-year follow-up. However, these studies are at too high a risk of bias to be conclusive. Validation is needed in long-term trials comparing LITT to other treatments.

Spinal LITT (sLITT) appears to be a promising modality for treatment of epidural metastatic spine disease in patients who are poor candidates for larger-scale procedures, and it works well with spinal stereotactic radiosurgery (SRS) to maximize local control and palliate pain. Utilizing intraoperative MRI guidance, sLITT was performed on 19 individuals with a variety of tumor types where metastatic vertebral disease was identified. The degree of epidural infiltration ranged from the tumor extending to the epidural space without displacement of the dura to epidural compression displacing the spinal cord with complete obliteration of the cerebrospinal fluid space. Median number of vertebral segments treated was 1 (range 1–3), with 80% of the involvement being the thoracic spine. Median hospital length of stay (LOS) was 2 days (range 1–14). One participant experienced post procedure transient L1 monoparesis, which resolved after 8 weeks. A second sLITT procedure was required at 16 and 33 weeks post procedure for 2 patients. One patient required salvage surgical intervention because of delayed progressive neurologic deterioration, and 1 patient developed a pathologic compression fracture 2 months post treatment requiring percutaneous stabilization. Mean preoperative Visual Analog Scale scores of 4.72 improved to 2.56 at 1 month and remained improved at 3 months postoperatively. Thirteen participants decreased their use of pain medication, whereas 3 increased medication usage (although only 1 of the 3 was a result of back pain). Preoperative mean quality of life index of 0.67, was unchanged at 1 month postoperatively, and improved to 0.83 at 3 months. MRI at 2 months post procedure showed a mean reduction in epidural tumor thickness of 22%, and the numeric scale of graded epidural compression showed an improvement from a preoperative mean of 3.8 to 2.9. The authors stated that the role of sLITT in the management of spinal metastasis needs to be compared with conventional surgery in a prospective randomized controlled trial (RCT), and that this initial evidence on the potential applicability of the technique will lay the foundation to pursue such a study (Thomas et al., 2017).

A Hayes report was performed on the use of LITT for the treatment of osteoid osteoma. A small body of literature was identified that spanned over 20 years which included a total of 14 abstracts (1 prospective uncontrolled study, 2 retrospective comparative studies, 6 retrospective uncontrolled studies, 1 retrospective cost comparison, 3 case reports, and 1 systematic review). Most of the studies were small and uncontrolled (total n=354). Overlap of investigators was noted for several of the studies, which means there may have been overlap of patient groups as well. Researchers concluded that while there is sufficient published evidence to evaluate this technology, the study abstracts present conflicting findings regarding LITT for the treatment of osteoid osteoma. Full-text review is required to confirm abstract content and, therefore, conclusions about the safety and efficacy of this technology cannot be made until a full assessment has been completed (2018).

Professional Societies

American Academy of Orthopaedic Surgeons (AAOS)

The AAOS does not endorse LITT for treatment of osteoid osteoma (2014).

Brain Tumors

Available evidence on LITT ablation of glioblastoma multiforme (GBM) and other high-grade gliomas (HGGs) is limited to small case series at high risk of bias. Published meta-analyses suggest that LITT may work as well as surgery, but findings need validation in prospective, multicenter studies with parallel control groups. Studies that assess LITT in conjunction with, or as an alternative to, stereotactic radiation therapy are also needed to define LITT's optimal place in the HGG treatment pathway. With regard to non-GBM cancers, only small, low-quality studies at high risk of bias are available, and their findings are unclear and inconclusive because studies included mixed patient groups with different types of brain cancer that have very different evolution and prognosis. Prospective, multicenter studies focusing on each etiology and comparing LITT with surgery and alternatives, such as stereotactic beam radiosurgery (e.g., GammaKnife®), are needed to address these evidence gaps (ECRI, 2019).

Kuo and colleagues (2019) retrospectively reviewed their experience with magnetic resonance-guided laser interstitial thermal therapy (MRgLITT) as treatment for pediatric patients with intracranial lesions in eloquent cortex, evaluating neurologic function and clinical outcomes. Five patients received MRgLITT, one experienced complications secondary to treatment, but none were discharged with a neurologic deficit. The researchers concluded that MRgLITT provides a less-invasive and potentially effective option for treatment in the management of pediatric epilepsy and tumors. A significantly larger study is required before attempting to draw any generalizable conclusions. Similarly, although all patients in this study recovered well without complication, long-term observation with more cases are necessary to adequately study MRgLITT as it becomes a more common approach for neurosurgical indications in both pediatric and adult populations.

Hong et al. (2019) conducted a retrospective review from a single institution comparing outcomes after LITT versus craniotomy in patients with recurrent lesions who were previously treated with SRS for brain metastases. Of 75 patients, 42 had recurrent tumor (56%) and 33 (44%) had RN. Of patients with tumor, 26 underwent craniotomy and 16 had LITT. For radiation necrosis (RN), 15 had craniotomy and 18 received LITT. There was no significant difference between LITT and craniotomy relative to neurological outcomes or in a patient's ability to taper off steroids. PFS and OS were similar for LITT versus craniotomy, respectively: PFS at 1-year = 72.2% versus 61.1%, PFS at 2-years = 60% versus 61.1%, OS at 1-year = 69% versus 69.3%, OS at 2-years = 56.6% versus 49.5%. Craniotomy resulted in

higher rates of preoperative deficit improvement than LITT. On subgroup analysis, the single factor most significantly associated with OS and PFS was pathology of the lesion. About 40% of tumor lesions needed postoperative salvage with radiation after both craniotomy and LITT. The researchers concluded that LITT was as efficacious as craniotomy in achieving local control of recurrent irradiated brain metastases and facilitating steroid taper, regardless of pathology. Craniotomy appears to be more advantageous for providing symptom relief in those with preoperative symptoms.

An extensive literature search was performed by Ashraf et al. on LITT and laser therapy in the context of glial tumors, metastatic lesions, pediatric brain tumors and RN. Reported complications in each series also were reviewed. Multiple studies have demonstrated the use, outcomes, and complications associated with LITT in neurosurgery over the past decade. While these same studies have consistently reported an overall benefit of LITT in cases in which traditional approaches are less advantageous, there have been complications reported from local effects of thermal damage, technical error, and edema development. Increased experience with the technology has reduced complications and brought more promising results, but standard protocols are lacking. The authors concluded that while LITT has shown efficacy in the treatment of gliomas, intracranial metastases, RN, and pediatric brain tumors, larger studies and clinical trials must be done to develop standardized protocols and indications for use (2018).

Eichberg et al. (2018) performed a pilot study on 4 individuals with recurrent cerebellar metastases who were treated with MRgLITT. The extrapolated average time for the lesion to shrink to below the initial size was 294.5 days. There was a trend toward a decrease in average edema volume from the preoperative MRI of 17.8 cm to final postoperative follow-up MRI of 3.4 cm. No postoperative hydrocephalus or complications occurred. The authors concluded that MRgLITT appears to be a safe and promising treatment for recurrent posterior fossa metastatic lesions up to 7.2 cm. Further RCTs are needed to further study the long-term efficacy of this therapy.

In a review of minimally invasive contemporary surgical approaches to deep-seated metastatic brain tumors, Marengo-Hillebrand and colleagues stated that LITT can increase the transient volume in the immediate postoperative period and lead to increased mass effect and neurological deficits. While temporary, these issues can persist for months and may necessitate pharmacologic support or surgical therapy. Therefore, LITT is not typically used as the initial treatment of metastatic brain tumors or for lesions with significant mass effect and/or in close proximity to eloquent structures (2018).

Karampelas and Sloan's review of LITT finds it attractive for patients with recurrent, deep-seated and/or critically located neoplasms refractory to other treatments. The technology has low morbidity and a shorter hospital stay, which equates to lower costs. Efficacy, particularly long-term follow-up, still is necessary through carefully planned RCTs (2018).

Kamath et al. (2017) conducted a retrospective study of patients with challenging diagnoses who received interstitial laser ablation (ILA). The focus of the study was to evaluate safety, efficacy, and preliminary outcomes within a diverse and large series of ILA treatments, as well as report useful technical details and operative trends. A total of 133 intracranial lesions in 120 patients were treated with ILA, including GBM, other gliomas, metastases, epilepsy foci, and RN. The rate of complications or unexpected readmission was 6%, and the mortality rate was 2.2%. With high-grade tumors, tumor volumes > 3 cm in diameter trended toward a higher rate of complication ($p = 0.056$). Median progression-free survival (PFS) and overall survival (OS) for recurrent GBM were 7.4 and 11.6 months, respectively. As a frontline treatment for newly diagnosed GBM, median PFS and OS were 5.9 and 11.4 months, respectively. For metastases, median PFS was not yet reached, and OS was 17.2 months. The authors concluded that ILA is a safe and efficacious treatment for a variety of intracranial pathologies, can be tailored to treat difficult-to-access lesions, and may offer a novel alternative to open craniotomy in properly selected patients.

Tovar-Spinoza and Choi published the preliminary results of the first series of pediatric brain tumors treated with MRgLITT at a single pediatric center. Outcomes were evaluated retrospectively for 11 patients with 12 tumors of 6 different types, all treated with the Visualase thermal laser system (Medtronic) between February 2012 and August 2014. Medical records, radiological findings, surgical data, complications, and results of tumor volumetric analyses were reviewed. A single laser and multiple overlapping ablations were used for all procedures. The mean hospital LOS was 3.25 days, and the mean follow-up time was 24.5 months. Tumor volume in all patients decreased in the first 3 months after surgery and continued to decrease by the 4- to 6-month followup. Two patients experienced transient post-ablation complications. The authors concluded that MRgLITT is an effective first- or second-line treatment for select pediatric brain tumors. Larger multi-institutional clinical trials are necessary to evaluate its use for different types of lesions to further standardize practices (2016).

Ivan et al. (2016) conducted a meta-analysis on the use of MRgLITT in the treatment of newly diagnosed HGGs. Eighty-five articles were identified plus one that is pending publication. Four articles were accounted for in this review in which 25 adults underwent LITT treatments. On average, 83% of the pre-treatment lesion volume was ablated. The average tumor volume treated was 16.5 cm., and the mean follow-up time was 7.6 months. Median overall survival

was 14.2 months (range 0.1-23 months). The median progression-free survival was 5.1 months (range 2.4-23 months); however, these data are limited by the relatively short follow-up of the patients reviewed and small sample size. Only one participant suffered a major perioperative complication (central nervous system infection). The researchers concluded that MRgLITT is a safe and promising technology for the treatment of small, yet difficult-to-treat newly diagnosed HGG, and that future randomized studies are needed to evaluate the role of this technology.

Lara-Velazquez and colleagues reviewed the advances in brain tumor surgery for GBM in adults. The researchers stated that because of the small number of studies, LITT and HGGs should be carefully considered. Future controlled clinical trials are needed to determine the optimal therapeutic regimen (2017).

Lee et al. (2016) conducted a review of the peer-reviewed literature evaluating the role of LITT in the treatment of recurrent HGGs for which current treatments have limited efficacy, and to discuss the possible role of LITT in the disruption of the blood-brain barrier to increase delivery of chemotherapy locoregionally. Six of 17 articles were thought to be most appropriate for this review. Sixty-four lesions in 63 patients with recurrent HGGs were treated with LITT. Frontal (n=34), temporal (n=14), and parietal (n=16) were the most common locations. Permanent neurological deficits, vascular injuries, and wound infection were seen in 7, 2, and 1 patients, respectively. Ablation coverage of the lesions ranged from 78% to 100%. The authors concluded that although experience using LITT for recurrent HGGs is growing, current evidence is insufficient to offer a recommendation about its role in the treatment paradigm for recurrent HGGs.

Barnett et al. conducted a systematic review and meta-analysis of the peer-reviewed literature to identify studies which examined extent of resection (EOR) or extent of ablation (EOA) and major complications (defined as neurocognitive or functional complications which last > 3 months post-surgery) associated with either brain LITT or open craniotomy in HGGs in or near areas of eloquence. Eight studies on brain LITT (n=79) and 12 craniotomy studies (n=1,036) were identified which examined either/both EOR/EOA and complications. Meta-analysis demonstrated an EOA/EOR of 85.4 ± 10.6% with brain LITT versus 77.0 ± 40% with craniotomy (mean difference 8%) and major complications of 5.7% and 13.8% for LITT and craniotomy, respectively. The authors concluded that in patients presenting with HGGs in or near areas of eloquence, early results demonstrate that brain LITT may be a viable surgical alternative (2016).

Medvid et al. discussed RN in an overview of applications of MRgLITT when treating brain pathology. Studies during the past 20 years report the use of LITT to treat a variety of brain lesions. The most studied lesions include glioma and metastases. Epilepsy and RN represent a much smaller subset of treated lesions reported in the literature, but RN is one of the 4 most common indications for the procedure. LITT induces resolution of RN, but long-term data are limited due to low numbers and lack of sufficient long-term follow-up. The authors concluded that LITT may provide a safe curative option in cases of RN. While studies offer a plethora of evidence on the safety profile of the procedure, evidence is limited because to date, all studies consist of non-controlled, non-randomized retrospective reports, case series, or case reports, thus predisposing to selection bias. Also, many of the studies mix multiple disease entities to increase the number of enrolled subjects; this mixture makes the evaluation of survival benefits for a given disease difficult (2015).

Evidence-based clinical practice guidelines endorsed by the Agency for Healthcare Research and Quality (AHRQ) do not address LITT in the management of patients with diffuse low grade glioma (Ryken et al., 2015) or progressive GBM (Olson et al., 2014).

Professional Societies

American Society for Radiation Oncology (ASTRO)

ASTRO does not address LITT in an executive summary of its evidence-based clinical practice guidelines on treatment for GBM (Cabrera et al., 2016).

American Association of Neurological Surgeons (AANS)

AANS does not address LITT in its evidence-based clinical practice guideline for management of progressive GBM (2014).

Congress of Neurologic Surgeons (CNS)

In its 2019 evidence-based guideline on the role of emerging and investigational therapies for treating adults with metastatic brain tumors, the CNS states there is insufficient evidence to make a recommendation regarding the routine use of LITT, aside from use as part of approved clinical trials (Elder et al).

Breast Tumors

An ECRI report found that available evidence on LITT for early-stage breast cancer consists of small case series, some of which are synthesized in systematic reviews. Findings are at high risk of bias and are of unclear significance

because of low statistical precision and because most patients underwent sequential LITT and resection, so the contribution LITT made to the outcomes cannot be discerned. Prospective studies with a parallel control group are needed to validate LITT as an alternative to surgery and to compare LITT with other minimally invasive techniques (2019).

Kerbage et al. (2017) performed a systematic review to evaluate the scientific publications investigating the LITT approach in malignant and benign breast disease. Three pre-clinical studies and 8 clinical studies (2 including fibroadenomas and 6 including breast tumors) were reviewed. Although the feasibility and safety of LITT have been confirmed in a phase I trial, heterogeneous inclusion criteria and methods seem to be the main reason for LITT not being yet an extensively used treatment option. The authors concluded that further development is necessary before this technique can be used in daily practice.

Haraldsdóttir et al. (2015) reviewed the effect of immunological changes induced by interstitial laser thermotherapy (ILT) on long-term outcome of patients with breast tumors. Twenty-four patients with invasive breast tumors were treated with ILT followed by standard surgical excision. Immunohistological reactions on immunocompetent cells were performed on specimens obtained before and after ILT. Follow-up time ranged from 91-136 months. The authors concluded that ILT did not have any long-term adverse effects. The clinical impact should be examined in a larger patient population.

Hayes conducted a review of published literature describing outcomes of LITT for treatment of breast tumors. Evidence consisted of 10 abstracts which included 1 prospective comparative study (n=17), 6 prospective uncontrolled studies (collective number of study participants = 664), and 3 review articles. Only 4 of the 7 study abstracts described LITT for breast tumors specifically. Those studies were very small, with overlap of investigators and possible overlap of patient groups. The remaining 3 studies described outcomes of LITT for breast tumor-related liver metastases rather than breast tumors per se and were included for informational purposes. Researchers concluded that there is insufficient published evidence to assess the safety and/or impact of LITT on health outcomes or patient management when treating of breast tumors (2018).

The National Institute for Health and Care Excellence (NICE)

Clinical guidance from NICE (2011) states current evidence on the safety and efficacy of ILT for breast cancer does not appear adequate to support the routine use of this procedure. It is suitable for use only within good-quality research studies.

Professional Societies

American Society of Breast Surgeons (ASBrS)

A 2018 consensus guideline by the ASBrS states that LITT is not approved by the U.S. Food and Drug Administration (FDA) for breast cancer treatment and recommends additional research.

Epilepsy

Grewal et al. performed a systematic review and meta-analysis comparing MRgLITT and SRS in cases of medically intractable temporal lobe epilepsy (TLE). A total of 19 studies were included in the final analysis. Of those studies, 9 were on MRgLITT (n=250), and 10 were on SRS (n=165). They identified that the overall seizure freedom rate was comparable between the 2 procedures (MRgLITT 50% vs. SRS 42%). Similarly, among patients with lesional pathologic conditions only, the seizure freedom rate between MRgLITT and SRS was also comparable at 62% and 50%, respectively. Compared with SRS, MRgLITT was associated with lower complication rates but similar reoperation rates. The authors concluded that outcomes and complications were similar between MRgLITT and SRS. Limitations of this review include a low level of evidence, as well as varying follow-up periods between the 2 procedures. More large-scale comparative studies are required to validate findings (2019).

Shimamoto and colleagues (2019) conducted a review of the current literature addressing clinical application of MRgLITT for the treatment of discrete, small epileptogenic lesions. Review of data from retrospective, uncontrolled studies suggests that MRgLITT may offer benefit when treating drug-resistant epilepsy because of mesial temporal sclerosis (MTS), hypothalamic hamartoma (HH), cavernous hemangioma, and small cortical dysplasias and malformations. It appears promising and has potential for reduced morbidity and improved tolerability compared with open surgery. While it is being offered as initial therapy in place of anterior temporal lobectomy (ATL) in many centers, studies must be done to compare efficacy and safety of MRgLITT with open surgery, and further investigation is needed to optimize this technique.

Dallas et al. (2018) addressed LITT in their review on neurosurgical approaches to pediatric epilepsy. They reported promising results of postoperative seizure freedom from published studies: 100% in 5 patients with focal epilepsy (Curry, 2012), 41% in 17 patients with various types of epilepsy (Lewis, 2015), and 50% in 20 patients with insular

epilepsy (Perry, 2017). While these results may be promising using LITT for certain patients, larger studies and populations are needed to accurately define appropriate pediatric candidates as well as treatment intent.

Hoppe and Helmstaedter conducted a systematic review on the use of LITT in pediatric epilepsy, retrieving 25 uncontrolled case series reports that included a total of 179 pediatric patients as well as 7 review papers that specifically referred to this surgical approach. HH represented the most frequent indication (64.2%), with therapeutic evidence for other more frequent etiologies underlying severe focal childhood epilepsies (e.g. focal cortical dysplasia, MTS) considered to be "scarce" (N < 20). For the published cases, the rate of severe complications was 3.4% and the overall complication rate was 23.5%. The seizure freedom rate (Engel class 1) was 57.5% (including patients with early follow-up and repeat thermoablations). None of the studies included the systematic evaluation of cognitive outcomes. The researchers found that, overall, the published evidence does not yet allow a scientific or clinical judgement on the utility of LITT for epilepsy surgery in the pediatric population. While it is a surgical options with regard to deep brain lesions (e.g., HH), any therapeutic superiority of LITT over open resection in cases that are equally accessible for both approaches remains to be demonstrated. Controlled, non-randomized outcome studies are recommended (2018).

A systematic review and analysis by Lagman et al. examined 2 commercially available MRgLITT systems used in neurosurgery: the Visualase® thermal therapy and NeuroBlate® Systems. Data extraction was performed in a blinded fashion. Twenty-two articles reflecting 223 patients were included in the analysis. The majority of patients (n=154/69%) received treatment with Visualase with epilepsy being the most common indication (n=8 studies/47%). Brain mass was the most common indication for NeuroBlate (n=3 studies/60%). There were no significant differences, except in age, wherein the NeuroBlate group was nearly twice as old as the Visualase group (p<0.001). Frame, total complications, and LOS were non-significant when adjusted for age and number of patients. Several limitations were cited in this analysis, including but not limited to inherent bias in selection and reporting and recognized issues of retrospective studies. The authors concluded that MRgLITT procedures have demonstrated effectiveness in the treatment of a variety of epilepsy etiologies and tumor pathologies. While laser neurosurgery has evolved over recent decades and clinical indications are currently being defined, long-term outcomes have yet to be fully elucidated (2017).

Jermakowicz and colleagues conducted a prospective review of all patients undergoing LITT for treatment of mesial TLE (MTLE) at a single institution. The goal of the study was to identify features of ablations and trajectories that correlate with optimal seizure control and minimize the risk of neurocognitive deficits. Standard preoperative and postoperative evaluations, including contrast-enhanced MRI and neuropsychological testing, were performed in all patients. Laser trajectory and ablation volumes were computed both by manual tracing of mesiotemporal structures and by non-rigid registration of ablation cavities to a common reference system based on 7T MRI data. Among 23 patients with at least 1-year follow-up, 15 (65%) were free of disabling seizures since the time of their surgery. Sparing of the mesial hippocampal head was significantly correlated with persistent disabling seizures (p = 0.01). A lateral trajectory through the hippocampus showed a trend for poor seizure outcome (p = 0.08). A comparison of baseline and postoperative neurocognitive testing revealed areas of both improvement and worsening, which were not associated with ablation volume or trajectory. The researchers determined that at 1 year, LITT appeared to be a safe and effective tool for the treatment of MTLE, although a longer follow-up period is necessary to confirm these observations. Better understanding of the impact of ablation volume and location could potentially fine-tune this technique to improve seizure freedom rates and associated neurologic and cognitive changes (2017).

Hoppe et al. (2017) reviewed and discussed the clinical experience with LITT in the field of epilepsy surgery with regard to complications, LITT-induced, long-term brain structural alterations, seizure outcome, preliminary neuropsychological findings and first estimates of treatment costs in approximately 200 cases. Overall, the seizure outcome appears to be slightly worse than for resective surgery. Due to insufficient research methods (e.g., non-established measures, lack of a control condition), the expected neuropsychological superiority over resective surgery has not been fully demonstrated thus far. Also, the cost-benefit ratio requires further critical evaluation. The authors state that stereotactic procedures and LITT in particular, while important instruments in the neurosurgical toolbox, probably do not represent (nor are they intended to represent) an alternative to, or replacement of, open resections. Adequately controlled, high quality, multi-center clinical outcome studies should be pursued.

In a focused review of technical details and application of MRgLITT for epilepsy, North and colleagues stated that the technology's primary application is for pediatric and adult focal epilepsies, although use in general epilepsies is being actively explored. They also stated that the minimally invasive approach may lessen neurologic and neuropsychological morbidity as well as appeal to individuals who may otherwise refuse traditional surgical treatments (2017).

Kang and Sperling (2017) conducted a review of laser interstitial thermal ablation and its use in treating drug resistant epilepsy. They stated that the procedure is highly selective and targets small lesions responsible for seizures, is far less invasive than open surgery, requires a shorter hospitalization, results in less pain and allows for a rapid resumption of normal activities. Initial results in MTLE are promising, with perhaps 50% of patients becoming seizure-

free after the procedure. Neuropsychological deficits appear to be reduced because of the smaller volume of ablated cortex in contrast to large resections. The authors concluded that more research with larger study groups is needed to establish optimal targeting of structures for ablation, surgical selection criteria, efficacy and adverse effect rates.

McCracken et al. (2016) conducted a prospective study on 5 consecutive patients using real-time magnetic resonance thermography (MRT)-guided stereotactic laser ablation (SLA) to treat medically refractory epilepsy secondary to cerebral cavernous malformations (CCMs). Each underwent stereotactic placement of a saline-cooled cannula containing an optical fiber to deliver 980-nm diode laser energy via twist drill craniostomy; MRI was used to evaluate targeting prior to ablation, as well as evaluation of targeting and near real-time feedback regarding extent of tissue thermocoagulation. Remote imaging (6 to 21 months post-ablation) was obtained in all patients, revealing no evidence of acute hemorrhage following fiber placement and confirming the desired extent of ablation. No adverse effects or neurologic deficits were identified. Four of 5 patients achieved freedom from disabling seizures after SLA alone (Engel class 1 outcome), with follow-up ranging 12 to 28 months. The authors concluded that minimally invasive MRT-guided SLA of epileptogenic CCM is a potentially safe and effective alternative to open resection. Additional studies and longer follow up are needed.

In a retrospective review, Waseem et al. evaluated a number of outcome measures, including seizure freedom, neuropsychological performance, complications, and other considerations on 38 patients presenting exclusively with MTLE and no other lesions (including neoplasia), who underwent MRgLITT. Eighteen (53%) had an Engel class I outcome, 10 patients had repeat procedures/operations, and 12 post-procedural complications occurred. Follow-up time ranged from 6 to 38.5 months. There was a decreased length of procedure time, hospitalization time, and analgesic requirement when compared to open surgery. In cases of well-localized MTLE, MRgLITT may offer similar (albeit slightly lower) rates of seizure freedom versus traditional surgery. The authors concluded that MRgLITT may be an alternative treatment option for high risk surgical patients and, more importantly, could increase referrals for surgery in patients with medically refractory MTLE. However, data is limited and long-term outcomes have not been evaluated. Further investigation is required to understand the potential of this minimally invasive technique for MTLE (2016).

Kang et al. (2016) prospectively tracked seizure outcome from a single center study which included 20 patients with drug-resistant MTLE who underwent MRgLITT from December 2011 to December 2014. Surgical outcome was assessed at 6 months, 1 year, 2 years, and at the most recent visit. Volume-based analysis of ablated mesial temporal structures was conducted in 17 patients with MTS and results were compared between the seizure-free and not seizure-free groups. Following LITT, proportions of patients who were free of seizures impairing consciousness (including those with auras only) are as follows: 8 of 15 patients after 6 months (53%), 4 of 11 patients after 1 year (36.4%), and 3 of 5 patients at 2-year follow up (60%). Median follow-up was 13.4 months post- LITT. Seizure outcome after LITT suggests an "all or none" response. Four patients had ATL after LITT; 3 are seizure-free. There were no differences in total ablated volume of the amygdalohippocampus complex or individual volumes of hippocampus, amygdala, entorhinal cortex, parahippocampal gyrus, and fusiform gyrus between seizure-free and non-seizure-free patients. Contextual verbal memory performance was preserved after LITT, although decline in noncontextual memory task scores were noted. The authors concluded that stereotactic MRgLITT is a safe alternative to ATL in patients with medically intractable MTLE. Individualized assessment is warranted to determine whether the reduced odds of seizure freedom are worth the reduction in risk, discomfort, and recovery time. Larger prospective studies are needed to confirm preliminary findings, and to define optimal ablation volume and ideal structures for ablation. Limitations to this review include a prospective review in a single center, as well as small sample size.

Tao et al. (2018) assessed outcomes of a combination therapy using both invasive electroencephalography-guided and stereotactic MRgLITT in the treatment of 19 individuals with drug-resistant MTLE. In all, 52% achieved freedom from disabling seizures at mean follow-up of 24 months. Further differentiating those with and without MTS, 73% and 30% of patients, respectively, were seizure-free at 2 years. The authors concluded that this technology can be a safe and effective alternative to traditional surgical approaches, particularly in patients with MTS, but larger-scale studies are likely needed.

In a 2016 review of minimally invasive surgical techniques for treating medically refractory epilepsy with defined epileptogenic foci, LaRiviere and Gross stated that MRgLITT reaches deep structures that would be inaccessible by open craniotomy, has the advantages of real-time imaging and monitoring of thermal dose delivery, and can achieve a larger ablation volume with unparalleled precision. They stated that with this new technique already FDA approved and widely accepted by physicians and patients, additional comparative trials have not been seen. Additional clinical trials will be necessary to demonstrate relative safety and effectiveness comparing MRgLITT to both continued medical therapy and standard open resection techniques.

A 2016 systematic review of LITT analyzed 2 studies on epilepsy and 4 on intracranial lesions (2 of which assessed the same patient population.) Three studies were case series, and 2 were non-randomized controlled studies. There was substantial heterogeneity among the included studies, in terms of LITT device used, type of LITT, comparator, patient

population, and outcomes measured. Among the 2 studies on epilepsy, 1 found that the LITT group experienced significantly less decline in famous face recognition and common names compared to stereotactic laser ablation hippocampotomy. The other study found no statistically significant difference between seizure rates for those who had MRgLITT compared to anterior mesial temporal resection. Findings showed that LOS was significantly shorter as was surgical time for those in the MRgLITT group, and the need for pain control was significantly less. Despite not finding a statistically significant improvement in seizure rates for those in the LITT group, this result suggests that LITT is equally effective at reducing seizures, while resulting in less pain, and shorter LOS for patients. The authors did note that LITT is not included in any clinical practice guidelines or incorporated into clinical care pathways for brain tumors or epilepsy (Leggett et al.)

Shukla et al. (2017) performed a review and summary of the evidence to date on the utilization of MRgLITT for MTL and other seizure disorders. The authors concluded that MRgLITT is a safe and effective therapeutic option for epilepsy in both the adult and pediatric populations. With improved outcomes and better side effect profile than other minimally invasive procedures, it enables surgical management of patients who are not good candidates for, or are otherwise opposed to, open resection. Study limitations included small sample sizes, the lack of availability of long-term outcomes data, and a scarcity of RCTs. Future studies may seek to address these gaps.

To report the feasibility, safety, and clinical outcomes of an exploratory study of MRgLITT as a minimally invasive surgical procedure for the ablation of epileptogenic foci in children with drug-resistant, lesional epilepsy, Lewis et al. (2015) performed a retrospective chart review of all MRgLITT procedures at a single tertiary care center. All procedures were performed using a U.S. FDA cleared surgical laser ablation system (Visualase Thermal Therapy System). Predefined clinical and surgical variables were extracted from archived medical records. From May 2011 to January 2014, 17 patients underwent 19 MRgLITT procedures. Mean age at seizure onset was 7.1 years, and mean age at surgery was 15.3 years. Surgical substrates were mixed but mainly composed of focal cortical dysplasia (n = 11). Complications occurred in 4 patients. Average postoperative hospital LOS was 1.56 days. Mean follow-up was 16.1 months (n = 16; range 3.5-35.9 months). Engel class I outcome was achieved in 7 patients (7/17; 41%), Engel class II in 1 patient (1/17; 6%), Engel class III in 3 patients (3/17; 18%), and Engel class IV in 6 patients (6/17; 35%). Three patients (3/8; 38%) with class I and II outcomes and 5 patients (5/9; 56%) with class III and IV outcomes had at least 1 prior resection. Fisher's test was not statistically significant for the association between Engel class outcome and previous resection. The authors concluded that the study provided descriptive results regarding the use of MRgLITT in a mixed population of pediatric, lesional, drug-resistant epilepsy cases. Further multicenter, prospective studies are required to delineate optimal candidates for MRgLITT, and larger cohorts are needed to more accurately define outcome and complication rates.

Professional Societies

American Association of Neurological Surgeons (AANS)

The AANS has not taken a position on LITT for treating patients with refractory epilepsy.

American Academy of Neurology (AAN)

The AAN policies and guidelines do not address LITT for treating patients with epilepsy

Prostate tumors

A 2019 ECRI report found limited evidence suggesting that LITT may be safe and without negative effects on sexual and urinary function in the short term (≤ 1 year) when used for localized prostate cancer; however, clinical trials have not yet demonstrated efficacy because studies have not assessed or reported on patient-oriented outcomes, such as 5-year OS or PFS. Available studies are at high risk of bias, and results need confirmation in prospective controlled trials that compare LITT to other treatments for localized prostate cancer, such as radical prostatectomy, cryotherapy, and radiation therapy (external or radioactive seed implants).

A systematic review & meta-analysis by Valerio et al. (2017) summarized the evidence regarding sources of energy employed in focal therapy for treatment of prostate tumors. Thirty-seven articles reporting on 3,230 patients undergoing focal therapy were selected, with one of the focal therapies being LITT. Four prospective Stage 1 to 2a studies evaluating LITT in 50 patients have been reported in literature. One study only included men with low-risk disease, whereas the other studies also included Gleason score $\leq 4+3$, although risk stratification was not clearly reported. The median age was 63.5 yrs; median PSA was 5.4 ng/ml; median follow-up was 4.5 months with all series including mandatory sampling after treatment. In the Stage 1 study, participants underwent radical prostatectomy, whereas in the other 3 studies participants underwent MR-transrectal ultrasound (TRUS) standard and/or targeted biopsy. Overall, the presence of significant and insignificant tumors was 4.8% and 22.2%, respectively. The probability of transition to secondary local treatment was 0%; overall and disease-specific survival, pad-free continence and potency preservation were 100% and 100%, respectively. No adverse events were reported in any study. The authors concluded that focal therapy seems safe and appears to offer good preservation of genito-urinary function. Tumor control in studies with intention to treat is encouraging, although this needs to be verified against standard of care in high quality comparative effectiveness trials.

Eggerer et al. (2016) conducted a phase II study evaluating MRI-guided focal laser ablation in 27 men with stage T1c-T2a prostate cancer. Inclusion criteria included prostate specific antigen (PSA) < 15 ng/ml or PSA density < 0.15 ng/ml³, Gleason score of 7 or less in 25% or less of biopsies, and MRI with 1 or 2 lesions concordant with biopsy-detected cancer. At 3 months, all patients underwent MRI with biopsy of ablation zone(s). At 12 months, all underwent MRI and systematic biopsy. I-PSS (International Prostate Symptom Score) and SHIM (Sexual Health Inventory for Men) scores were collected pre-treatment, and at 1, 3 and 12 months. The primary end point was no cancer on the 3-month ablation zone biopsy. Secondary end points were safety, 12-month biopsy, and urinary and sexual function.

At 3 months 26 patients (96%) had no evidence of cancer on MRI-guided biopsy of the ablation zone. No significant I-PSS changes were observed. SHIM was lower at 1 month ($p = 0.03$), marginally lower at 3 months ($p = 0.05$) and without a significant difference at 12 months ($p = 0.38$). At 12-month biopsy, cancer was identified in 10 patients (37%) (inside the ablation zone(s) in 3 cases (11%) and outside the ablation zone(s) in 8 (30%)). Cancer was identified both in and outside the ablation zone in 1 participant. The authors concluded that in select individuals with localized prostate cancer and visible MRI lesions, focal laser ablation has an acceptable morbidity profile and is associated with encouraging short-term oncologic outcomes. Significantly longer followup is mandatory to fully assess this treatment.

In their 2015 review of MR-guided focal ablation for localized and recurrent prostate cancer, Woodrum and colleagues stated that while the technology is rapidly becoming a viable alternative to standard treatment options, all the focal therapy treatments suffer from a small number of patients and need to be compared with established therapies. Multicenter, prospective clinical trials are critically needed to assess the advantage of each treatment modality and to determine long-term efficacy.

There are multiple clinical trials studying LITT for various conditions which are in different phases of activity. Additional information is available at www.clinicaltrials.gov. (Accessed March 5, 2019)

The National Comprehensive Cancer Network (NCCN) Practice Guidelines do not address laser thermal therapy or laser ablation as treatment in tumors of the prostate, central nervous system, bone, lung or breast, or as treatment for RN (2019).

Professional Societies

American Society of Clinical Oncology (ASCO)

ASCO clinical guidelines do not address laser thermal therapy as treatment in tumors of the genitourinary system, head and neck, breast, bone, or in neurooncology (2018-2019).

U.S. FOOD AND DRUG ADMINISTRATION (FDA)

LITT is a procedure and, therefore, not subject to FDA regulation.

The NeuroBlate[®] System (Monteris Medical, MN) enables MRI-guided neurosurgical ablation, monitoring 3-D and providing real time imaging to support a surgeon's clinical decision matrix. The device was FDA approved on October 26, 2016. Additional information is available at <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm?ID=K162762>. (Accessed May 9, 2019)

The Visualase[®] Thermal Therapy System (Medtronic, MN) provides advanced MRI-guided laser ablation technology for thermal ablation markets, including neurosurgery. Delivery of laser energy results in rising temperatures in the target area, destroying the unwanted tissue. The device was FDA approved on September 10, 2008. Additional information is available at: <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMN/pmn.cfm?ID=K081656>. (Accessed May 9, 2019)

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GUIDELINE HISTORY/REVISION INFORMATION

Date	Action/Description
08/01/2019	<p>Applicable Codes</p> <ul style="list-style-type: none"> Added CPT codes 20999 and 27599 <p>Supporting Information</p> <ul style="list-style-type: none"> Updated <i>Clinical Evidence</i> and <i>References</i> sections to reflect the most current information Archived previous policy version MMG154.D

INSTRUCTIONS FOR USE

This Medical Management Guideline provides assistance in interpreting UnitedHealthcare standard benefit plans. When deciding coverage, the member specific benefit plan document must be referenced as the terms of the member specific benefit plan may differ from the standard benefit plan. In the event of a conflict, the member specific benefit plan document governs. Before using this guideline, please check the member specific benefit plan document and any applicable federal or state mandates. UnitedHealthcare reserves the right to modify its Policies and Guidelines as necessary. This Medical Management Guideline is provided for informational purposes. It does not constitute medical advice.

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