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Magnetic Resonance Neuroblate Fusion for Treating Glioblastomas

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Introduction:

The Neuroblate Fusion system utilizes magnetic resonance guided laser therapy to ablate tumors and lesions. The system requires the use of Laser Interstitial Thermo Therapy (LITT) to activate thermocoagulation and focus of tissue destruction. This is a minimally invasive alternative to traditional brain surgery, giving patients a shorter recovery time and fewer complications. Neuroblate Fusion may also be an additional treatment to chemotherapy or radiation therapy. Neuroblate Fusion is best used for treating glioblastomas in the brain and occasionally for reducing the potential for seizures. Under sterile conditions, a small burr hole is made in the patient's skull which allows the neurosurgeon to accurately place the probe onto the area of interest. Concurrently with the surgical procedure, real-time magnetic resonance imaging (MRI) is performed. This helps to assist the surgeons in precisely locating the glioblastoma and destroy the carcinogenic tissues with the laser, while avoiding the surrounding healthy tissues and anatomy. Neuroblate Fusion is a great treatment option for patients who are suffering with aggressive tumors such as glioblastomas. Laser therapy gives patients a new hope and a better chance of survival. Recurrence of glioblastomas are common after patients undergo a first surgery without the use of Neuroblate Fusion. Destroying the tumor proves to be more successful after a second surgery is done using laser therapy. In the future, Neuroblate Fusion may become the gold standard for treating glioblastomas.

The Role of MRI:

- The Neuroblate Fusion System was approved by the FDA in 2009. (University Hospitals, 2020, p. 1)
- In 2020, Monteris Medical announced FDA clearance of it's Neuroblate Fusion-S Software. (Biospace, 2020, p. 1)

  Private company that develops LITT.
- Prior to the MRI of the brain, a computed tomography (CT) scan of the brain is done to locate the tumor(s).
- Contrast enhanced MRI remains the primary form of imaging to assess the size and spread of brain tumors.
- In contrast enhanced MRI for the evaluation of a glioblastoma, both inflammation and any abnormal vasculature will be demonstrated.
  - a defining pathologic feature of glioblastomas is the presence of thick, irregular nodules. (Schmitt & Stein, 2016, p. 87)
- Real-time MRI helps to assist in the surgical intervention and treatment of tumors.

Normal

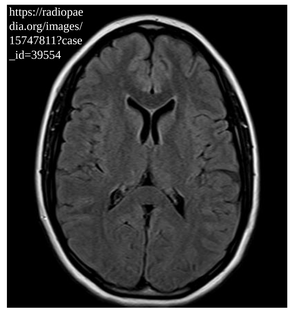

Figure 1. Axial MR image of a normal brain without a glioblastoma

Abnormal

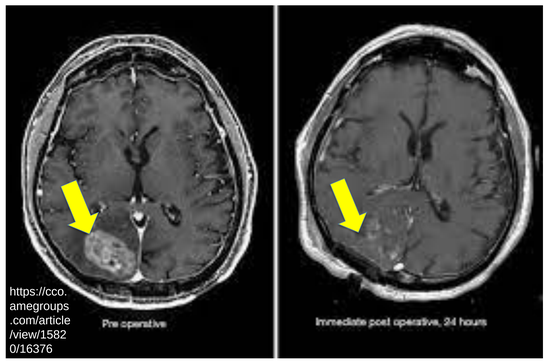

Figure 2. Axial MR images of a brain with a glioblastoma pre-operative and 24-hour post-operative (see arrows)

Glioblastoma:

- A glioblastoma is a rare, life-threatening brain tumor that originates in the glial cells of the brain or spinal cord.
- Glioblastomas are generally found in the cerebral hemispheres of the brain.
- Common symptoms of having a glioblastoma include headache, memory loss, seizures, speech and balance difficulties, and confusion. (Newman, 2018, p. 3)
- The exact cause is unknown.
- Factors that increase the risk of having a glioblastoma include age (most common), radiation exposure, and family history.

  Age 60 years and older have a higher likelihood of glioblastoma.
- Treatments include Neuroblate Fusion, chemotherapy to stop the cancerous cell growth, target drug therapy to suppress the abnormalities, tumor excision for removal, and radiation therapy to destroy the abnormal cells.

Figure 3. Neuroblate Fusion probe being used in an OR suite

Neuroblate Fusion:

- Neuroblate Fusion is a robotically controlled laser therapy that also utilizes real-time MRI to ablate tumors.
- Neurosurgeons use intraoperative magnetic resonance imaging (iMRI) to create accurate images of the brain that guide them in removing brain tumors, such as glioblastomas.
- Prior to the start of the procedure, the neurosurgeon plans the surgical approach and chooses which probe would work best.
- The patient is then transferred to the operating suite with their head remaining stabilized.
- Under MRI guidance, the surgeon accurately places the probe and delivers the laser energy to ablate the area of interest. If necessary, a second trajectory can be made using a single laser probe.
- Neuroblate Fusion is a minimally invasive procedure and is tolerated very well by patients. Most patients are discharged quickly, have a short recovery time, and only have 1-2 stitches.

  Follow-up MRI images of the tumor begin to show evidence of tumor death immediately after the procedure.
- Indications for the use of Neuroblate Fusion include the size, shape, and location of the tumor.

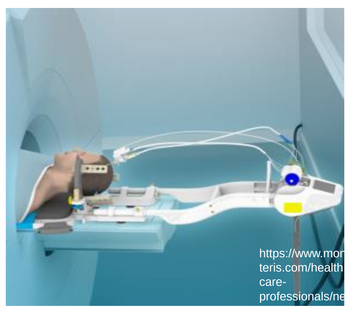

Figure 4. Robotic probe attached to patient's head in the MRI unit

Neuroblate Fusion vs. Craniotomy:

Neuroblate Fusion	Craniotomy
• Minimally invasive • A small burr hole is made to insert the probe • Risks such as bleeding, infection, edema, tissue damage, and hematoma are less likely to occur (Monteris Medical, 2021, p. 5) • Average hospital stay is about 3.5 days (Montemurro, 2020, p. 2)	• Is the standard surgery for most brain tumors • A section of the skull is removed to access the tumor • Risks such as bleeding, infection, edema, tissue damage, and hematoma are more likely to occur • Average hospital stay is 1 week

Statistics:

- A research study was done to show the outcomes of survival in patients with glioblastomas who undergo LITT.
  - 17 research articles were found with a total of 203 patients with recurrent glioblastomas who underwent 219 LITT procedures.
  - The morbidity rate was only 6.4%. Zero deaths reported related to the LITT procedure.
  - Average overall survival rate after the initial diagnosis was 14.7 months. (Montemurro, 2020, p. 2)
- Without treatment for glioblastoma, the average survival is only a few months, but even with treatment survival is usually around 1 year.
- For patients who have surgery to resect the tumor along with chemotherapy or radiation therapy, the overall survival is still only about 14 months. (Eldridge, 2020, p. 3)

Conclusion:

Overall, Neuroblate Fusion is beneficial for treating aggressive tumors such as glioblastomas. It is a minimally invasive alternative to traditional brain surgery. Research demonstrates that laser therapy is safe and the overall survival rate for patients is high. With the Neuroblate system proving to be effective, we are continuing to provide new hope to patients suffering with glioblastomas. Real-time MRI laser therapy allows neurosurgeons to accurately assess the tumors and plan out the ablation process. In the future, medical professionals will continue to create better MRI technology that will improve patient care and patient's quality of life. Neuroblate Fusion is relatively new and is not readily available in every facility. Researchers are exploring a more widespread use of laser therapy throughout the world to become the gold standard of treatment of glioblastomas.

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