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MRI-guided laser interstitial thermal (ablation) therapy (MRgLITT)

Abstract: Epilepsy is an ancient disease which is also known as the "sacred disease". During an epileptic seizure, the usual electrical activity in the brain becomes altered. About one-third of people with epilepsy will eventually develop refractory epilepsy, this means that medicines fail to work efficiently to control the seizures. If patient has refractory epilepsy, the type of seizures you have may affect the treatment. Seizures may be primary (generalised), this means they involve a lot of your brain tissue on both sides of your brain or they may be partial (focal) seizures, this means seizure activity starts in a smaller area of your brain and may later spread out to a wider area. The field of neurosurgery is constantly researching for new options for patients with refractory epilepsy. Some of the manipulations include VNS vagus nerve stimulation, hemispherectomy, Multiple Subpial Transection (MST), etc., One of the major breakthrough is a MRI-guided laser-induced thermal ablation for epilepsy.

Keywords: Refractory epilepsy, MRI, laser, thermal ablation.

Topicality: MRgLITT is a new technique which is used in many countries including Russia. It was originally approved by FDA (food and drug association of US) in 2010.

Aim: To determine the feasibility of placement of a stereotactic laser ablation catheter into a brain lesion with the use of MRI real-time, via a safe, accurate, efficient, and minimally invasive manner.

Method: Surgical approach to refractory epilepsy is a modern day concern, hence, MRI-guided laser interstitial thermal therapy (MRgLITT), a procedure for destroying affected tissue-using heat. To deliver this energy in a minimally invasive fashion, Placement of a small (1.6 mm., pencil lead size) fiber optic probes into target brain tissue requires only a 3.2 mm. diameter skull opening and has even been performed on awake patients using only local anesthetics. This small diameter fiber optic applicator is inserted into the lesion through a keyhole stereotactic procedure. The thermal energy induces damage to intracellular DNA and DNA-binding structures, ultimately leading to cell death. (This procedure is done very efficiently so that no harm is done to surrounding tissues). The ablation procedure is supervised by real-time MRI thermal mapping and confirmed by immediate post-ablation T1 or FLAIR MRI images which is why we can very well control and direct the area to be treated as there is colour changes instantly on the MRI computer screens, it gives an opportunity to do a controlled manipulation. It is an exciting new minimally invasive technology with an emerging use for lesionectomy of a variety of epileptogenic focuses (hypothalamic hamartomas, cortical dysplasia, cortical malformations, tubers) or as a disconnection tool allowing a new option of treatment without the hassles of an open surgery. Although highly promising, the long-term effects of laser ablation as a viable treatment option for neurological disorders have yet to be rigorously studied and quantified.

Results: This process of MRgLITT is a minimally invasive surgery which gives a wide opportunity to treat the patient without any major damage to the adjacent areas of brain. After this procedure the patient needs a time period of a few weeks to months to heal but the outcome is positive by now. The patients are discharged within 24–48 hours after the operation. There is almost no post-operative complications yet noted, no reoccurrence of seizure stated. After 2–13 month follow up in patients has shown good results.

Conclusion: MRI-guided laser interstitial thermal therapy has a significant potential to be a minimally invasive alternative to more conventional techniques to surgically treat medically refractory epilepsy in children.This latest technique gives a wide scope to all types of branches such as neurosurgery, pediatric neurosurgery and many more.

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