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## **Laser Interstitial Thermal Therapy in Brain Tumors: Predictive Value of Overlap between Hyper-Thermic Field and Corticospinal Tract as Manifested in Post-Op Motor Deficit**

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**Introduction:** Laser interstitial thermal therapy (LITT) has revealed promising results in treatment of difficult to access tumors. There is limited data regarding the predictive role of hyper-thermic field exposure to important white matter fiber tracts in post-op neurological deficit. To that end, we report the clinical relevance of thermal exposure to corticospinal tract (CST) in our LITT series.

**Method:** Thirty-six patients underwent LITT, using NeuroBlate System in Cleveland Clinic (4/2011 to 4/2013). Of those, 24 patients who had pre-op DTI were included (16 glioma, 3 metastasis, 4 radiation necrosis). One patient with post-operative ICH and motor deficit as a direct result was excluded.

Extent of hyper-thermic field is delineated by the software as thermal-damage-threshold (TDT) lines, which include white TDT-line (60 min at 43°C), blue TDT-line (10 min at 43°C), and yellow TDT-line (2 min at 43°C).

Fiber tracking was conducted for motor fibers of upper extremities (UEM), lower extremities (LEM), as well as pre-motor fibers (PM). Pre-operative MRI and TDT-lines were imported to iPlan software for volumetric analysis. The maximum surface area of overlap between fibers of the UEM, LEM, PM as well as the TDT-lines of white, blue, and yellow were analyzed in three planes of axial, coronal, and sagittal imaging.

Clinical review was conducted for post-op motor deficit with either complete or partial resolution. The degree of thermal exposure to the each of the CST correlated with manifestation of post-op motor deficit.

**Results:** Overlap of TDT-lines and CST in number of patients treated were as follows: white (UEM:6, LEM:7, PM:6), blue (UEM:9, LEM:10, PM:2), yellow (UEM:12, LEM:10, PM:10). Median overlap of yellow TDT-lines with UEM, LEM, PM, were 1.9 mm<sup>2</sup>, 1.5mm<sup>2</sup>, 2.6mm<sup>2</sup> respectively, blue TDT-lines with UEM, LEM, PM, were 0.4mm<sup>2</sup>, 1mm<sup>2</sup>, 1.8mm<sup>2</sup> respectively, and white TDT-lines with UEM, LEM, PM, were 0.1mm<sup>2</sup>, 0mm<sup>2</sup>, 0mm<sup>2</sup>, respectively. Deficits with complete resolution of motor movements of arms (3), and legs (3), as well as deficits with partial resolution of arms (2), and legs (1) were evaluated post-operatively. In three occasions with permanent motor deficit, overlap of white, blue, and yellow TDT-lines to corresponding motor-tract were  $\geq 2.2\text{mm}^2$ ,  $\geq 4.6\text{mm}^2$ , and  $\geq 5.9\text{mm}^2$  respectively.

**Conclusion:** Permanent deficit can be noted even in minimal overlap of TDT-lines and motor fibers. Therefore, in pursuing LITT therapy, the goal of treatment is a conformal coverage of tumor volume and minimal overlap of hyper-thermic field with important white matter fiber tracts, to minimize post-op neurological deficits.