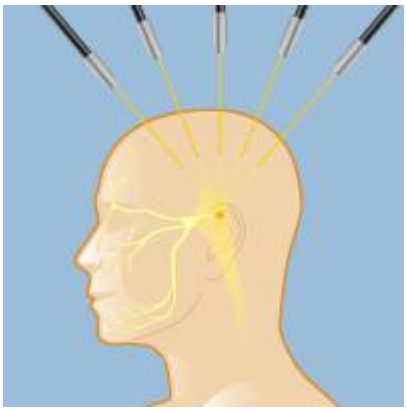
Gamma knife radiosurgery for trigeminal neuralgia mechanism



Gamma Knife radiosurgery for trigeminal neuralgia (GKRS) is a noninvasive surgical treatment option. The long-term microstructural consequences of radiosurgery and their association with pain relief remain unclear.

Studies focusing on the electrophysiology properties of partially demyelinated trigeminal nerves submitted to radiosurgery are vital to truly advance our current knowledge in the field [1].

To better understand this topic, Shih-Ping Hung et al., used diffusion tensor imaging (DTI) to characterize the effects of GKRS on trigeminal nerve microstructure over multiple posttreatment time points.

Ninety-two sets of 3-T anatomical and diffusion weighted MR images from 55 patients with TN treated by GKRS were divided within 6-, 12-, and 24-month posttreatment time points into responder and nonresponder subgroups (≥ 75% and < 75% reduction in posttreatment pain intensity, respectively). Within each subgroup, posttreatment pain intensity was then assessed against pretreatment levels and followed by DTI metric analyses, contrasting treated and contralateral control nerves to identify specific biomarkers of successful pain relief.

GKRS resulted in successful pain relief that was accompanied by asynchronous reductions in fractional anisotropy (FA), which maximized 24 months after treatment. While GKRS responders demonstrated significantly reduced FA within the radiosurgery target 12 and 24 months posttreatment ($p < 0.05$ and $p < 0.01$, respectively), nonresponders had statistically indistinguishable DTI metrics between nerve types at each time point.

Ultimately, this study serves as the first step toward an improved understanding of the long-term microstructural effect of radiosurgery on TN. Given that FA reductions remained specific to responders and were absent in nonresponders up to 24 months posttreatment, FA changes have the potential of serving as temporally consistent biomarkers of optimal pain relief following radiosurgical treatment for classic TN [2].

Histopathology examination of the trigeminal nerve in humans after radiosurgery is rarely performed and has produced controversial results.

There is evidence of histological damage of the trigeminal nerve fibers after radiosurgery therapy. Whether or not the presence and degree of nerve damage correlate with the degree of clinical benefit and side effects are not revealed and need to be explored in future studies [3].

Existing studies leave important doubts as to optimal treatment doses or the therapeutic target, long-term recurrence, and do not help identify which subgroups of patients could most benefit from this technique [4].

References

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