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Cyberknife Radiosurgery for Trigeminal Neuralgia: Long Term Results on a Large Cohort of Patient

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Abstract
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Abstract

Objectives: Frameless image-guided Cyberknife radiosurgery was introduced at Stanford in 2002 to treat TN and has been shown over time to be a safe and efficacious alternative to frame-based radiosurgery. Our group has consistently reported over the years the outcomes of Cyberknife frameless radiosurgery. However a report over a large cohort of patients with long-term follow-up was still missing. This paper aims to report the clinical results after Cyberknife radiosurgery on 426 patients with up to 12 years follow-up.

Methods: the treatment technique here described was developed at the Cyberknife Center of CDI (Milano,Italy).The protocol aims to deliver non-isocentric homogeneous irradiation (60 Gy) to an extended segment of the trigeminal nerve(6 mm) without hot spots. Retreatments are performed on patients resistant to treatment (no pain improvement within 6 months) or with recurrent pain. A lower dose (45Gy) is typically prescribed for the second treatment to reduce the risk of sensory complications. Pain control and sensory complications have been assessed using the dedicated BNI scales.

Results: Retrospective review of medical records available at CDI showed 426 patients treated with Cyberknife radiosurgery for TN, with an average follow-up of 62,5 months(range 36-146 months) . Mean age at the time of treatment was 65,8 years(median: 67,5; range: 25,3-99,6). Nerve compression by a vessel was found in 60,2%, contact but no evident compression or distorsion in 21,4%, no contact in 18,4%. 396 patients(93%) had no previous procedures. BNI pain score pre-treatment was IV in 186(43,3%) and V in 235(54,7%).BNI facial numbness score was I in 401(93,3%) and II in 29(6,7%).Mean latency to pain freedom after treatment was 3,2 months(median: 3 months). At last follow-up, BNI pain scale score rate was I in 70,5%, II in 20,3%, IIIa in 3,8% , IV in 2,1% and V in 3,3%. 84 patients required a retreatment for recurrent or relapsing pain. Average time of retreatment was 23,1 months(median 13,6 months, range: 1-110 months).Average latency of pain relief after retreatment was 2 months(median 1 month).
Rates of pain freedom have been strongly affected by retreatments(RT) as estimated BNI pain score I, II and IIIa without retreatment was , respectively, 61,6%(versus 70,5% with RT), 13,5%(versus 20,3%) and 2,2%(versus 3,8%) . The rate of new not bothering facial numbness(BNI grade II) after single treatment was 12,8% while bothering paresthesias/disesethesias (BNI grade III and IV)appeared in 1%. If retreatments are included the rate of BNI grade II,III and IV are respectively 21,9% , 3% and 0,5% with an overall rate of 26,4%. Thus the rate of bothering paresthesias/disesthesias following the treatment was 4,5% (1% after single treatment plus 3,5% after retreatment). No other major neurological complcations are reported.

Conclusion(s): Frameless image-guided robotic radiosurgery is a safe and effective option to treat TN as proved by long-term results in a large cohort of patients. This study shows the impact of retreatments to improve the overall rate of pain relief and a minimal rate of sensory complications after the first treatment, increasing to a 4,5% rate of BNI grade III and IV scores after the second treatment. These results compare favourably with any other technique available to treat drug-refractory TN.