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Robotic Image-Guided Radiosurgery for Trigeminal Neuralgia: Results after 10 Years

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Abstract
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Pantaleo Romanelli [1] , Livia Corinna Bianchi [2] , Giancarlo Beltramo [2]

1. Neurosurgery, Cyberknife Center, Centro Diagnostico Italiano, Milano, ITA 2. Radiation Oncology, Cyberknife Center, Centro Diagnostico Italiano, Milano, ITA

Corresponding author: Pantaleo Romanelli, radiosurgery2000@yahoo.com

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Abstract

Objective: 668 patients with Trigeminal Neuralgia (TN) have been treated at the Cyberknife Center of CDI (Milan) during the last 12 years. Long-term follow-up (10 years) is available for 84 patients.

Methods: Patients with typical TN and severe medically-refractory pain were selected and treated with image-guided robotic radiosurgery (CyberKnife) by a single neurosurgeon (PR). Treatment was delivered in single session without hospitalization, lasting on average 55 minutes. Pre-operative imaging included thin cuts (0,5 mm) post-contrast stereotactic head CT as well as volumetric post-contrast MR (MPRAGE) integrated by Fiesta images. A 6 mm segment along the midcisternal course of the nerve was drawn. A 60 Gy dose was prescribed to the 80% isodose. The same dose was delivered if a second treatment was needed; over time the second dose was reduced to 45 G. Clinical re-evaluation was performed regularly for 4 years, then yearly follow-up calls were made or further clinical evaluations performed if needed. Visual analogue scores (VAS, 0-10) and Barrow Neurological Institute (BNI) scale (I-V) have been used to assess the pain level before the treatment and during the follow-up. VAS scores >7 and BNI grade IV-V, both indicating severe pain, were required to undergo the treatment. A reduction of VAS score >5 and inclusion in the BNI class I-II were considered as a meaningful way to assess development and duration of pain relief as well as pain relapses. BNI facial numbness scale (I-IV) was used to assess the development of sensory disturbances following the treatment. Patient with sensory complications fell in the III and IV BNI numbness scores.

Results: Pain relief rate in 343 patients was 92% after 6 month, 87% after 1 year and 76% after 3 years. 5- and 10-years follow-up is available for 84 patients, with relief rates of 74% and 72% respectively. 15 patients within this group required a second treatment due to lack of efficacy of the first treatment (4) or pain relapse (11). BNI grade III sensory complications were found in 7 and 5 patients after, respectively, 5 and 10 years. Except 2 patients receiving a single treatment, in which the symptoms regressed from bothering (grade III) to non- bothering (grade II) between the 5 and 10 years time point, all the others received two treatments (both delivering 60 Gy). One further patient developed dysesthesias (BNI grade IV) after 2 treatments delivering 60 Gy (the second one done because of relapsing pain) and received a contralateral medial thalamotomy 7 years after the first treatment, with regression to grade II BNI score. Overall the rate of sensory complications at 5 and 10 years was, respectively, 9,5% (8 Patients) and 5,9%(5 patients).

Pain relief rate 10 years after robotic image-guided radiosurgery for TN was satisfactory in over 2/3 of the patients treated. Sensory complications in the patients receiving 2 treatments delivering 60 Gy to the same 6 mm target led to the reduction of second treatment dose to 45 Gy. This lower dose was later observed to induce a much lower rate of sensory complications without affecting pain relief rates. Of note, aside from sensory complications, no other neurological complications have been found.

Conclusion: Long-term follow-up confirms the efficacy and safety of image-guided robotic radiosurgery for TN. Second treatments are useful to achieve pain relief in patients not responding to or relapsing after a first treatment.