

# Evaluation of the Long-Term Response and Pain-Free Survival Rate in Refractory Trigeminal Neuralgia after Cyberknife Radiosurgery: A Retrospective Analysis of a Case Series.

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## Abstract

**Introduction:** Cyberknife® radiosurgery (CK-SRS) represents an effective treatment modality for refractory trigeminal neuralgia (TN) in patients who are suitable candidates for the procedure. The aim of this work is to report the long-term response and pain/numbness free survival rate in patients with refractory TN at 1 month (n=23), 1 year (n=20) and 2 years (n=10) post-treatment, as well as possible complications.

**Method:** This study analyzed 23 patients with refractory TN treated with CK-SRS at our clinic from September 2022 to May 2025. They received a single dose of 90 Gy with CK, except for one case of re-irradiation at 75 Gy. Baseline facial pain and at 7, 15 and 30 days, as well as 1 to 2 years post-treatment was evaluated using the Visual Analog Scale, while the BNI Pain Intensity and Facial Numbness Score were obtained before treatment and at latest follow-up for patient outcomes. Other toxicities besides facial numbness were assessed.

**Result:** The mean follow-up of this cohort was 18 months. The change in BNI was toward pain reduction in 21 of the 23 patients (91.3%), from BNI I to II with fewer cases toward IIIa or IIIb, while one remained the same (IV) and one worsened (IV to V). Initially patients reported severe pain with a mean VAS score of 10 (range 8-10). Early responses after SRS (7-30 days) showed a significant reduction in pain ( $p < 0.001$ ), as most patients' scores dropped to 4-6. At one year, these results were sustained ( $p = 0.065$ ). Patients with a 2-year follow-up maintained pain reduction from year 1 ( $p = 0.337$ ), with scores predominantly 0-1, except for patients 1 and 2. The most common side effect was non-bothersome facial hypoesthesia, emerging early and persisting in 13 patients (56.5%). Pain-free survival rate showed at 6 months 87% of patients were pain-free (BNI I-II), and the estimates at 12 and 24 months were 68% and 60%, respectively. Five people had previously undergone other non-pharmacological

treatment; their response was parallel to those who received SRS as a first option ( $p = 0.921$ ).

**Discussion:** Immediate and successful pain relief has been reported at a median time of 7 to 30 days, others like Yomo et al. have reported at a median follow-up of 50 months an FPS score of 1.1 (SD 1.6) ( $P < 0.001$ ). As a limitation, we highlight the scarce availability of articles on long-term pain response at 1 or 2+ years in refractory TN treated with CK-SRS.

**Conclusions:** CyberKnife® radiosurgery proved to be a minimally invasive and effective treatment alternative with relatively rapid pain relief for patients with refractory TN, as evidenced by significant early reduction in VAS and BNI scores and sustained outcomes at 1 and 2 years.

## References

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