

Fifteen years of Gamma Knife surgery for trigeminal neuralgia in the *Journal of Neurosurgery*: history of a revolution in functional neurosurgery

Editorial

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Reappraisal of a Dated Idea

In 1994 the Leksell Gamma Knife Society, under the presidency of Prof. Kintomo Takakura, held its meeting in Kyoto, Japan. I presented 5 cases of trigeminal neuralgia that had been successfully treated using the Gamma Knife at a dose of 90 Gy and an anterior cisternal target (retrogasserian target).²⁷ My presentation was very well attended and raised a great deal of interest because of its “novelty”! In fact, 37 years earlier, the first radiosurgical procedure in a human had been performed by Lars Leksell to treat trigeminal neuralgia by targeting the gasserian ganglion as seen on x-ray films.¹² After treating a series of 40 patients, the Leksell team abandoned this approach because Lars Leksell discovered the efficacy of the glycerol injection.⁸ This injection was first used for visualization of the Meckel cave but turned out to be sufficient to stop pain in a significant percentage of patients.⁸ The clear limitations of other medical and surgical therapeutic options, on the one hand, and the possibility of accurate direct targeting of the cisternal portion of the nerve, on the other hand, explains the revival of the idea of radiosurgery for tic douloureux in the early 1990s.

A Seminal Multicentric Study

Doug Kondziolka came to me with a short series of patients who had been treated less successfully in Pittsburgh using a lower dose of radiation. He proposed that

Abbreviations used in this paper: DREZ = dorsal root entry zone; GKS = Gamma Knife surgery; *JNS* = *Journal of Neurosurgery*; MVD = microvascular decompression.

we combine our two series for a publication demonstrating the dose effect in treating trigeminal neuralgia. Some months later, after we had added more cases from Rhode Island and Seattle, we were able to publish, in the *Journal of Neurosurgery* (*JNS*), what is now considered a seminal paper demonstrating for the first time the safety efficacy of GKS at maximum doses between 70 and 90 Gy.¹⁰ That paper initiated a profound change in radiosurgical practice, which rapidly translated into more patients undergoing radiosurgery (Fig. 1) and a large number of papers documenting its safety efficacy (Figs. 2–4). Interestingly, many key papers were also published in *JNS* (Fig. 4).

The Major Contribution of *JNS* to the Establishment of Gamma Knife Surgery

This supplement contains the 25 most frequently cited articles in *JNS* on GKS for trigeminal neuralgia according to a recent search of *Web of Science*. The majority of these “Top 25” papers have made great scientific contributions to the field. Soon after the multiinstitutional study was published in 1996,¹⁰ good short-term safety efficacy of GKS was confirmed by three studies of large cohorts of patients treated using the so-called DREZ target (site of the dorsal root entry zone).^{14,22,30} These papers established better long-term results in patients who had not previously undergone surgery. However, globally, papers in the literature frequently report results based on very heterogeneous methodologies. Because the effect of radiosurgery is delayed, efficacy can be appreciated very differently if authors report only initial pain cessation, with or without medication, rather than long-term freedom from pain without medication (Table 1). Sometimes

Gamma Knife Surgery for Tic World Wide since 1992

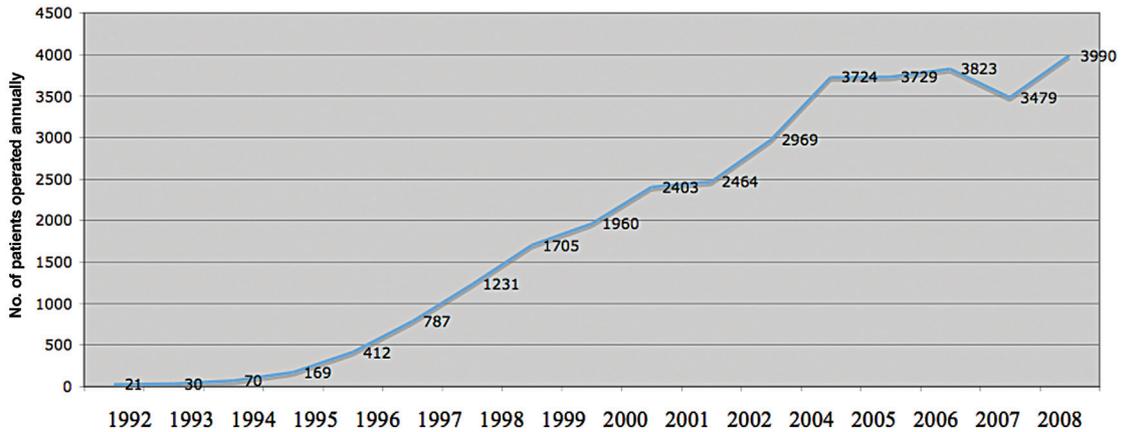


Fig. 1. Line graph showing the total number of patients treated for trigeminal neuralgia worldwide using GKS.

patients who no longer feel pain are mixed with patients who have more than a 90% reduction in the number of pain attacks! We consider it mandatory to report patients who are free from pain, with or without medication, separately from patients whose pain has improved but has not completely ceased. Additionally, rates of recurrence after surgery (whatever the approach) are significant, and authors must report Kaplan-Meier rates of pain freedom at 1, 2, 3, or more years instead of freedom from pain at the last follow-up. The only prospective trial published to date was one published in *JNS* by our group in 2006.²⁹

That paper fulfills all the major criteria for “quality reporting in surgery for trigeminal neuralgia,” specified by Zakrzewska in 2003,³⁴ with the exception of minimum follow-up, which was 1 year in the paper.

Nuances in Technique Make Significant Differences in Clinical Results

In the early 1990s, thanks to magnetic resonance imaging, Rand²⁴ proposed to move the radiosurgical target from the ganglion to the cisternal segment of the nerve.

Number of articles

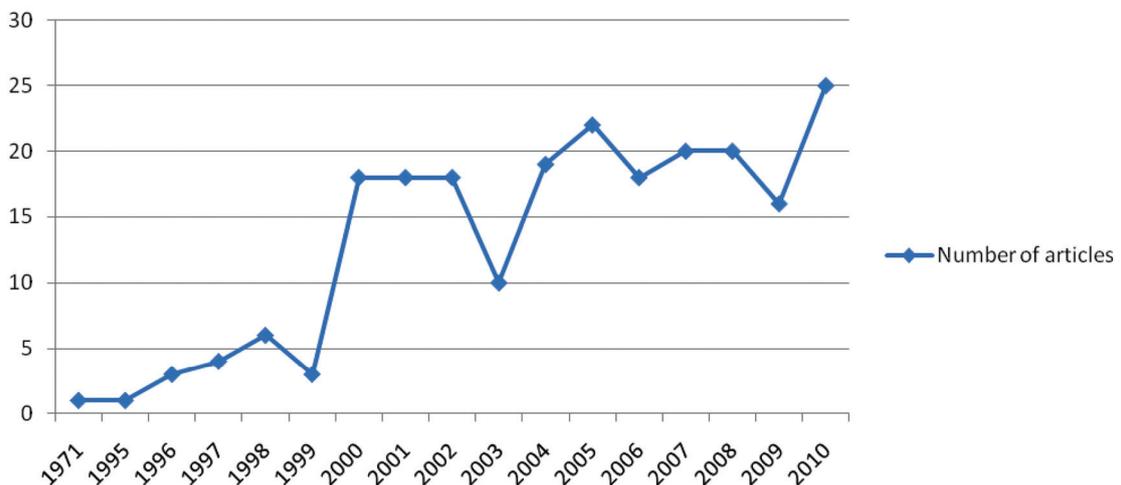


Fig. 2. Line graph showing the number of peer-reviewed papers on GKS for trigeminal neuralgia published annually since Lars Leksell’s initial paper according to PubMed.