

CURRICULUM VITAE

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Gamma Knife Radiosurgery

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The concept of stereotactic radiosurgery (SRS) is derived from the understanding and the use of stereotactic neurosurgery, which was first designed in 1951 to give a single high ablative dose to intracranial targets with a sharp dose fall-off replacing the needle electrode as a functional neurosurgery alternative.

Although all SRS treatment modalities use convergent beam techniques to avoid any secondary effects on the surrounding healthy tissues, they accomplish this in very different ways. SRS using Gamma Knife (Elekta AB, Stockholm, Sweden) typically encompasses targets within the 50% isodose using multiple isocenters created by numerous circular collimated beams converging at one point (the isocenter).

In contrast, the dose distribution generated by a gantry-mounted linear accelerator (LINAC)-based SRS system (e.g. the Novalis Tx) is influenced by the beam shaping devices, the number of beams/arcs used and the treatment technique used. It accomplishes similar treatments with the use of multiple intersecting non-coplanar arcs or applies multiple intensity-modulated beams. Typically the encompassing prescription dose is the 80% isodose. Micro-multileaf collimation has emerged as a major beam-shaping technology for LINAC-based SRS, with the aim of improving the conformity.

A LINAC mounted on a flexible robotic arm offers another concept of treatment delivery. Cyberknife (Accuray, Sunnyvale, CA, USA) accomplishes the treatments with several hundred treatment beams out of a repertoire of thousand possible beam directions using inverse planning. These beams are delivered in an isocentric manner via circular collimators of varying size or in a non-isocentric manner with the use of multiple pencil beams.

Until now most of data available about dosimetry and clinical outcome for SRS treatments come from Gamma Knife treatments. Here I reviewed the influence of beam collimation on the treatment planning by comparing the Leksell Gamma Knife Perfexion with dedicated other SRS systems in treating multiple brain metastases and benign lesions such as arteriovenous malformations and acoustic neuromas.

