AbstractID: 3758 Title: Beam Configuration of Photon-based Stereotactic Radiosurgery

Purpose

Unequivocally, the experience of Gamma knife has set a solid notion pertaining to the definition and the dosimetric requirement of radiosurgery. Any newer, post-Gamma knife, radiosurgery system has to demonstrate comparable targeting precision and sharp dose gradient characteristics.
Statistics shows that the total of number of beams used in Cyberknife treatment is often less than 200. Herein, we present a study to evaluate the dose distribution characteristics comparing with that of the traditional photon-based radiosurgery.

Material and Method

An experimental beam path with beam positions (notes) distributed in 2π solid angle was created to compare the dose distribution of

a. Single isocenter plan with different collimator sizes and with the total number of beams ranging from 30 to 205.
b. Multiple isocenter conformal plan and non-isocentric inverse conformal plan.
c. Multiple non-coplanar beam arrangement and Multiple coplanar beam arrangement

Results and Discussion

For single isocenter plans, no significant differences were observed in isodose levels ranging from 90% to 10%, with number of beams ranging from 55 to 205, distributed over 2π solid angle. With beam number reduced to 50, the noticeable differences fall in the dose levels under 10%.

The conformal planning using multiple isocenters increases the number of beams geometrically, while no-isocentric inverse planning can achieve excellent conformity with much less number of beams. However, close attention is needed to assure the dose fall-off is well controlled in all directions.

Although the reduction of beam number may not affect significantly the dose gradient in the median-high dose region, to deliver all beams in a single plane does result in a much inferior dose distribution. The attempt to use a single co-planar delivery for radiosurgery is thus to be avoided.