AbstractID: 8073 Title: SRS Planning, QA and Clinical Applications on the GammaKnife

Quality Assurance, Planning and Clinical Results for Gamma Knife Radiosurgery

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The Leksell Gamma Knife was created in 1968 as a dedicated intracranial stereotactic radiosurgery device. By the mid 1980's linear accelerators had been modified to also perform this important function. Gamma Knife radiosurgery is extremely well accepted with nearly 400,000 treatments at more than 250 centers worldwide reported by December, 2006. Gamma Knife radiosurgery is recognized by hospitals in the United States as a form of surgery and as such must be treated with abundant caution. Successful radiosurgery requires a highly trained and disciplined team of surgeons, radiation oncologists, medical physicists, nurse and other medical personnel.

The AAPM Report 54 published in 1995 made specific recommendations for Quality Assurance of the Leksell Gamma Knife Model U. This device was rapidly succeeded by the Model B, Model 4C with Automatic Positioning System (2000) and the Perfexion (2007). Each of the new models features more motorized precision placement of the intracranial target under computer controlled. Thus, a whole new set of QA challenges faces the medical physicist and treatment staff.

Rigorous acceptance testing of a new Gamma Knife is mandatory, followed by a detailed characterization of all imaging equipment to be used in treatment planning. Small field dosimetry and characterization of beam profiles by a Qualified Medical Physicist is also necessary before treatments can begin. Remote dosimetry of both absorbed dose and beam profiles is highly recommended. It is important to attempt to analyze all systematic errors in the entire end-to-end process to establish limitations on treatment accuracy. Treatment of trigeminal neuralgia, which requires treatment of a nerve only 3mm in diameter with a beam only 4mm in diameter, is an ultimate test for Gamma Knife radiosurgery.

New gamma stereotactic radiosurgery units including the Gamma Knife Perfexion and the American Radiosurgery GammaART 6000 feature moving cobalt-60 radiation sources. These poses a difficult challenge for regulatory officials who must evaluate and safely license such devices, often without ever seeing them in operation. The U.S. Nuclear Regulatory Commission placed the Gamma Knife Perfexion in Part 35.1000 "Other medical uses of byproduct material" rather than 35.600, which specifically includes "gamma stereotactic radiosurgery". The NRC Advisory Committee on the Medical Use of Isotopes (ACMUI), with input from AAPM Task Group 172 is seeking to rewrite part 35.600 to be more inclusive and less prescriptive, enabling all gamma stereotactic radiosurgery units to fit within this section.

New protocols and recommendations need to be written to include the new motorized, computer controlled units which did not exist in 1995. Great care must be taken to ensure rigorous QA standards are created and maintained.

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Educational objectives:

1. Learn challenges of Gamma Knife radiosurgery
2. Important points to remember when beginning a new program
3. Challenges of new Gamma Knife Perfexion and rotating gamma units