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Quality Assurance in Stereotactic Radiosurgery and Fractionated Stereotactic Radiotherapy

In the 50-plus years since it was first introduced, stereotactic radiosurgery, high-dose irradiation of cranial neoplasms delivered in a single fraction, has become a standard of care in the treatment brain tumors, vascular malformations, functional disorders, and pain. Modern radiosurgery can be performed non-invasively and on an outpatient basis, yet with an extremely high degree of accuracy. Within the past ten years, the field of radiosurgery has seen numerous technological enhancements, including: the development of dedicated devices for stereotactic delivery, the use of relocatable frames to facilitate fractionated delivery, the development of image guided and “frameless” approaches, and the application to extracranial tumor sites. Each of these developments is accompanied by its own challenges in assuring targeting and dosimetric accuracy. In this presentation we review the technologies for stereotactic localization and treatment of cranial targets with particular emphasis on the quality assurance aspects associated with establishing and maintaining a clinical radiosurgery program. Specifically, the presentation will:

1. Differentiate how radiation is delivered for Gamma Knife and Linac-based (conventional and robotic) stereotactic radiosurgery.

2. Define the treatment planning parameters for Gamma Knife and Linac-based stereotactic radiosurgery.

3. Discuss measures for assuring accuracy in stereotactic localization and dose delivery for Gamma Knife and Linac-based stereotactic radiosurgery.