



# A Focus on Stereotactic Radiosurgery in Neurosurgery

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In the medical and surgical arena, the term *radiosurgery* was initially used more than 90 years ago by Dr. Francis Hernaman-Johnson [1]. He described radiosurgery in the context of an address to the Royal Society of Medicine as an assortment of indications where X-ray therapy could be coupled with surgery for benign and malignant pathologies. In his address, he seemingly saw into the future with his comment that “no human mind can compass the whole field of medicine. Hence the hope of the future lies in specialism [*sic*] tempered by co-operation.” Later in the twentieth century, the term radiosurgery was defined by Swedish neurosurgeon Lars Leksell in a fashion that represents its contemporary usage as a procedure to treat a variety of benign and malignant intracranial neoplasms as well as selected vascular and functional disorders [2]. Applying principles of stereotactic surgery and harnessing the tissue- and tumor-ablative potential of high energy ionizing radiation, Leksell designed the first prototype unit for stereotactic radiosurgery (SRS), opening up new clinical opportunities and ongoing valuable clinical benefits for patients.

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More recently, the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the American Society for Radiation Oncology (ASTRO) agreed that a uniform description of SRS was required, and the consensus definition is as follows [3]:

- *Stereotactic radiosurgery is a distinct discipline that utilizes externally generated ionizing radiation in certain cases to inactivate or eradicate (a) defined target(s) in the head or spine without the need to make an incision. The target is defined by high-resolution stereotactic imaging. To assure the quality of patient care, the procedure involves a multidisciplinary team consisting of a neurosurgeon, radiation oncologist, and medical physicist.*
- *Stereotactic radiosurgery (SRS) typically is performed in a single session, using a rigidly attached stereotactic guiding device, other immobilization technology, and/or a stereotactic image-guidance system, but can be performed in a limited number of sessions, up to a maximum of five.*
- *Technologies that are used to perform SRS include linear accelerators, particle beam accelerators, and multisource Cobalt 60 units. In order to enhance precision, various devices may incorporate robotics and real-time imaging.*

Contained within this definition are references to several essential elements of SRS. The treatment is minimally invasive and involves external radiation sources or beams. It blends the fields of neurosurgery, physics, engineering, and radiation oncology. By its very nature, stereotactic radiosurgery is multidisciplinary in its delivery. In stereotactic radiosurgery, the neurosurgeon's role is much more than applying a stereotactic frame.

The field of radiosurgery is poised for appreciable growth in the years to come. There are now more cases of stereotactic radiosurgery for brain tumors than there are craniotomies [4]. The use of radiosurgery extends to cerebrovascular disease (e.g., arteriovenous malformations), neuro-oncology (e.g., benign and malignant brain tumors), pediatric neurosurgery, skull base neurosurgery (e.g., acoustic neuromas), spine (e.g., spinal metastasis), and functional neurosurgery (e.g., trigeminal neuralgia).



**Fig. 59.1** Dr. Sheehan caring for a patient

Stereotactic radiosurgery is also quite cost-effective and often affords favorable quality of life outcomes for patients making it well poised for the forces impacting health care reform [5]. For those interested in an aspect of neurosurgery that relies upon technology, engineering, and stereotaxis, the pursuit of stereotactic radiosurgery will likely be appealing as it has been for me. As with many endeavors, passion for the field is the key to success in the field of radiosurgery (Fig. 59.1).

### **Key Points**

1. Stereotactic radiosurgery is multidisciplinary by its very nature.
2. Stereotactic radiosurgery is very versatile and transcends virtually all traditional sections within neurosurgery.
3. The technique of radiosurgery is well poised for growth and health care reform in the future.
4. Neurosurgeons play an essential role in the selection, delivery, research, and management of patients undergoing stereotactic radiosurgery.

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## References

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