

History of Radiosurgery in Korea

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Stereotactic Radiosurgery including hypo-fractionated stereotactic body radiation therapy is one of the well accepted treatment modalities in Korea these days. Various radiosurgery dedicated machines such as Gamma Knife[®], CyberKnife[®], and Novalis[®] have been installed in the recent decades and treat about 7,000 patients annually. The beginning of radiosurgery in Korea was not so splendid, however. In the late 1980's, radiosurgery using modified conventional linear accelerators (LINACs) was tried under the influence of the successful clinical outcomes after Gamma Knife Radiosurgery (GKS) or LINAC radiosurgery in the other countries. In 1988, The Catholic University of Korea Seoul Saint Mary's Hospital and Yonsei University Severance Hospital modified their LINACs by applying self-developed technique and treated some patients in a single session, respectively. Seoul National University Hospital also developed its own LINAC radiosurgery system in early 1990's and called it a Green Knife. These early trials of LINAC radiosurgery were labor-intensive and time-consuming procedures like in other countries. The radiation beam was too weak and the home-made devices were not refined. Usually, radiosurgery started late in the afternoon or early evening after completion of traditional radiation treatments and finished late in the night. The technique in the low scale of accuracy and long treatment time were main obstacles for the LINAC radiosurgery to be spread across the nation. Though several teams continued their efforts to use conventional LINACs for radiosurgery, the main stream of radiosurgery was conveyed to the radiosurgery dedicated machines.

In May 1990, the first Gamma Knife[®] in Korea was installed at Asian Medical Center in Seoul. The machine type was model B and it was the first Gamma Knife[®] in Asia. The unit was located in the basement of the hospital as usual, but, unfortunately, it was flooded in September 1990 after 69 treatments. A new machine was installed and began to treat patients in May 1991. The introduction of Gamma Knife caused popularization of radiosurgery in Korea. In 1992 two other Gamma Knives were installed and treated more than 300 patients per year. There were five Gamma Knives in Korea and more than 700 patients were treated annually in 2000. The model C Gamma Knife was first installed in Seoul National University Hospital in December 2003 and model Perfexion in October 2008.

Stimulated by the successful operation of Gamma Knife, other radiosurgery dedicated machines

were introduced in Korea. In November 2000, the first Novalis® unit began to work at the Inje University Ilsan Paik Hospital in Goyang-shi. In June 2002, the third generation model of CyberKnife® was installed at Korea Cancer Center Hospital, Seoul and it was the first CyberKnife® unit in Korea. Contrary to the fact that Gamma Knives and Novalis's were managed at the department of neurosurgery until then, it was run mainly by the department of radiation oncology. The successful operation of the first CyberKnife unit and introduction of other advanced radiosurgery machines let other radiation oncologists equip their own LINAC radiosurgery devices.

The year 2004 was one of the most important periods in the history of radiosurgery in Korea. Korea runs a unique national healthcare system. The government decides whether a certain treatment modality is covered by the healthcare system or not. Once a modality is covered by the system, the economic burden of the patients is reduced to around one-third of the uncovered costs usually. In March 2004, Korean government decides to cover the brain radiosurgery by the national healthcare system. Since then many patients could choose radiosurgery with much less economic burden and hospitals could purchase radiosurgery dedicated machines under the assumption of increased use of the machines. In the last eight years since 2004, the number of radiosurgery machines was increased considerably. In March 2012, 16 Gamma Knives are running and about 4,000 Gamma Knife radiosurgeries are performed annually. Two more units will be installed by the end of this year. More than 30,000 patients have been treated using Gamma Knife since 1990. There are seven Novalis units including Novalis-Tx, and one is under installation. About 700~800 procedures are performed using Novalis per year and the total cumulative number of the treated patients is around 3,000. CyberKnives in Korea are nine in number and the 10th unit will be installed soon. They treat about 2,000 patients annually and the cumulative patients reach about 10,000. There are also 16 Tomotherapy® units in Korea. However, it is used mostly for 3D conformal radiation therapy or intensity modulated radiation therapy, though it can work as a radiosurgery device.

As the number of people working in the field of radiosurgery increases, the radiosurgery society was formed naturally. The Korean Radiosurgery Society was founded in 2003 and about 150 members are now active. The 7th annual meeting of the society will be held on March 23rd, 2012. The Korean Society of Medical Physicists for Radiosurgery was also formed in 2003 and the 10th meeting is scheduled on November 30th, 2012. Seoul National University Hospital hosted the 13th International Meeting of Leksell Gamma Knife Society in May 2006, the 9th Congress of the International Stereotactic Radiosurgery Society in June 2009, and the 1st Meeting of the Asian Leksell Gamma Knife Society also in June 2009.

It is difficult to stipulate what is the most common indication of radiosurgery in Korea because there is no official statistics. In general, cerebral arteriovenous malformation and benign brain tumors such as vestibular schwannomas and meningiomas have been the most common indication of brain radiosurgery. In the recent years, the number of brain metastasis patients has been considerably increased and it occupies more than half of indications at some radiosurgery sites. Stereotactic body radiation therapies to treat various cancers are under rapid increment these days, too.

Radiosurgery is now well established and spread in Korea. More than 35 radiosurgery units will be working at the end of 2012 and more than 8,000 patients will be treated a year. The indications are expanding from benign brain diseases to malignant brain diseases and body cancers. With these quantitative developments, there are trends to study basic principles on radiosurgery and to develop safer and more efficient methodology.