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Development and future of epilepsy surgery in Korea

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Abstract

Epilepsy surgery in Korea began as early as in the 1940s and continued to develop through the second half of the 20th century. Introduction of neuroimaging modalities, establishment of epilepsy monitoring units and the epilepsy team approach contributed to the rapid development. For about 300-400 operations carried out yearly, there is at present sufficient number of epilepsy surgery centers and qualified neurosurgeons in Korea. However, Korean neurosurgeons should adapt themselves to changing recent trends. Etiologies of epilepsy have dramatically changed from head trauma and infectious diseases to tumors and developmental abnormalities. Although traditional resective surgery still constitutes the main bulk of the operations, new therapeutic procedures based on neuro-modulation are emerging as alternative treatments. There should also be active participation in basic science research which would leads to future innovations in the treatment of epilepsy.

HISTORY OF EPILEPSY SURGERY IN KOREA

Modern Western medicine was introduced in Korea in the late 19th century. Surgery, enriched with detailed anatomical and physiological knowledge, and empowered by inhaled anesthesia, was of special interest, because traditional Korean medicine has focused on herbal medicine and correction of imbalance of internal homeostasis. Several medical schools and hospitals were established by the government and missionaries from Western countries in the late 19th century. They continued to develop and serve as the centers of medical practice and education, during the political turmoil of the early 20th century.[1]

During the colonial era (1910-1945) under Japanese occupation, the Korean medical education system followed the German-Japanese tradition, and surgical departments were not divided into organ-specific specialties. In 1940s, a few pioneers deeply interested in neurosurgical operations started the history of Korean neurosurgery. Dr. Si-chang Kim at Seoul National University performed lobectomy and cortical vessel ligation for a dozen of epilepsy patients. Dr. Ki-sup Lee at Yonsei University Hospital performed leucotomy for epilepsy patients.

The 1950s began with a tragic event in Korea, the Korean War. It was an unprecedented disaster for all people involved. However, Korean neurosurgery had acquired, ironically, a chance to make a great leap during the war. Many neurosurgeons from the U.S. and European countries came to Korea and worked as army surgeons. Many Korean surgeons participated in the operations of head-injured casualties and learned advanced neurosurgical techniques. Edward A. V. Busch, a Danish neurosurgeon who came to provide aid on the Hospital Ship Jutlandia, made great efforts both in treatment of war casualties and in educating Korean neurosurgeons. He also operated on the first case of cerebral paragonimiasis in Korea.[2]

After the Korean War, although massive destruction and economic hardship left little resource for education, Korean neurosurgeons were eager to learn modern neurosurgical practice. Many of them studied in the U.S. and Europe. Dr. Bo Sung Shim was one of them. After studying in the U.S. and returning to Seoul National University, he performed hemispherectomy for the first time in Korea in 1958. In late 1950s, neurosurgical departments became independent from general surgical departments in many hospitals. This is followed by the establishment of the Korean Neurosurgical Society in 1961.

Microsurgery and computed tomography (CT), the two major advances that revolutionized neurosurgical practice were introduced first in Seoul National University Hospital, in the early 1970s and in 1979 respectively. MRI was introduced in 1983 and became widely available in the late 1980s. The first epilepsy monitoring unit was founded at Yonsei University Hospital in 1990

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and was followed by the establishment of advanced epilepsy surgery programs in many hospitals. In 1994, the first PET center was established at Seoul National University Hospital which also became a common facility for neurosurgical practice. By 2002, 1000 cases of epilepsy surgery have been performed in the Seoul National University Hospital, which was also the first hospital to introduce magnetoencephalography (MEG) service in 2005.

ESTIMATES OF EPILEPSY PATIENTS

Unfortunately, as there is no nationwide epidemiologic survey for epilepsy, the number of epilepsy patients in Korea and the number who are surgical candidates can only be estimates. As of 2005, the total population of Korea is 48 million.[3] The prevalence of epilepsy is said to be 0.4 - 1.0% of the general population.[4] The number of epilepsy patients in Korea is thus estimated to be around 300,000 - 400,000. It is believed that about 20 - 30 percent of the epilepsy patients are drug-resistant, and about half of the drug-resistant patients are potential candidates for epilepsy surgery. Thus, there are around 30,000 - 60,000 epilepsy surgery candidates in Korea.

TRAINING HOSPTIALS AND EPILEPSY SURGEONS

As of 2003, there were 80 training hospitals with neurosurgery-training programs and over 1,600 practicing neurosurgeons in Korea. At least 17 of these training hospitals have epilepsy surgery programs. Around 300 - 400 operations are performed yearly, most of the surgeries are performed in the major hospitals: Asan Medical Center, Seoul National University Hospital, Yonsei University Hospital, Samsung Medical Center, Catholic Medical College, Dongsan Hospital, Chonbuk National University Hospital, Kyungpook National University Hospital and Ajou University Hospital. Because there are many hospitals and neurosurgeons capable of performing epilepsy surgery, no neurosurgeon can be dedicated only to epilepsy surgery. Every epilepsy surgeon also specializes in other fields, for example, neuro-oncology, functional surgery and spinal surgery.

TYPES OF EPILEPSY SURGERY

Table 1 is a summary of epilepsy surgery performed during 2004 at Seoul National University Hospital and Asan Medical Center, two representative hospitals with active epilepsy surgery programs. Table 2 shows the longitudinal data of the types of operations performed at Seoul National University Hospital, from 1994 to 2005. As shown, temporal and extemporal resections along with invasive monitoring constitute the majority of operations. However, neuro-modulation techniques, such as vagus nerve stimulation (VNS) and deep brain stimulation (DBS) are now attracting the interest of many neurosurgeons. By the end of 2005, over 100 cases of VNS have been performed in Korea and clinical experiences with DBS for epilepsy are increasing.

Table 1. Types of epilepsy surgery performed during 2004 in Seoul National University Hospital and Asan Medical Center

	SNUH	AMC
Temporal resection	28	24
Extratemporal resection	21	7
Invasive monitoring	17	19
Hemispherectomy	2	1
Corpus callosotomy	1	3
Multiple subpial transection	1	4
Vagal nerve stimulation	0	3
Deep brain stimulation	0	2
Total	70	63

SNUH = Seoul National University Hospital; AMC = Asan Medical Center

Table 2. Types of epilepsy surgery performed in Seoul National University Hospital from 1994 to 2005

Temporal resection		584	46.6%
	medial TLE	418	
	lateral TLE	166	
Extratemporal resection		238	19.0%
Invasive monitoring		382	30.6%
Hemispherectomy		16	1.3%
Corpus callosotomy		18	1.4%
Multiple subpial transection		4	0.3%
Vagal nerve stimulation		9	0.7%
Endoscopic disconnection for HH		1	0.1%
DBS		0	0%
Total		1252	100%

TLE = temporal lobe epilepsy, HH = hypothalamic hamartoma, DBS = deep brain stimulation

FACILITIES FOR EPILEPSY SURGERY

Epilepsy surgery developed dramatically, in correspondence with the use of new diagnostic modalities such as EEG and MRI. Currently most hospitals with an epilepsy surgery program are well-equipped with advanced diagnostic facilities. Moreover, a highly competitive medico-economic environment in Korea has made it imperative to adopt novel technologies for research and clinical application. As of 2005, there are over 1500 CT scans, 565 MRIs, 35 PET centers with 43 scanners, 10 epilepsy monitoring units and 1 MEG facility in the country. Most of the MRIs are 1.0 or 1.5 T models, with many 3.0 T MRIs available in major hospitals for detailed neuroimaging studies.

CHANGING TRENDS OF EPILEPSY SURGERY

The most important change in this respect is a shift of etiologies. At the early stage of epilepsy surgery development in Korea, head trauma, tuberculoma and parasite infestation were the major causes of localization-related epilepsy.[5,6] Head trauma, however, decreased gradually since the late 1990s with strenuous public campaigns against motor vehicle accidents. Tuberculosis and parasite infestation, such as, paragonimiasis, cysticercosis and sparganosis, previously endemic in some rural areas of Korea, decreased dramatically over the last 15 years by improvement of hygiene and general living conditions., At present, central nervous system manifestations of these diseases are seldom seen in clinical practice. Instead, epilepsy surgery for brain tumors and focal cortical dysplasia are increasing, mainly because of the wide availability of advanced neuroimaging techniques.

Responsibility for epilepsy patient care also has changed in recent years. Previously, social organizations played an important role in providing general care and supplying antiepileptic drugs to patients with low socioeconomic status. They provided many patients with the minimum required care. But the limitations of this approach became obvious, as the required level of expertise and treatment cost rose rapidly. Currently, care of epilepsy patients are almost exclusively the responsibility of the medical professions: Neurologists, pediatric neurologists, neurosurgeons, some psychiatrists and general physicians. Establishment of the National Health Insurance in 1989 provided most epilepsy patients with specialized medical care. Social organizations currently focus on educating patients and advocating for their rights against societal discriminations. They also serve as a medium for communication between patients and medical professions.

With the advent of epilepsy monitoring units, team approach to epilepsy care has been established in many hospitals. Team

approach is a patient-centered practice and is particularly valuable for presurgical planning and postoperative management. Meanwhile, there is increasing cases of pediatric epilepsy surgery. Although the importance of early surgery in drug-resistant childhood epilepsy has been emphasized[7], pediatricians as well as parents are reluctant to refer the patients for surgery. Epilepsy team approach can help to change this. Currently, pediatric cases still account for less than 10% of total epilepsy surgery in Korea.

The Korean Ministry of Health and Welfare decided that MRI was to be reimbursed by National Health Insurance from 2005. Previously, epilepsy patients were required to pay out of their own pocket for brain MRI, which cost about 300-500 USD per study. Repeated MRI scans for pre- and postoperative studies were thus a heavy economic burden to patients. The government also decided to give epilepsy patients tax benefits and subsidies from 2003. Such financial assistance to epilepsy patients is very important, as many of the patients were unemployed and suffered from poverty. All these policies help to facilitate the development of epilepsy surgery in Korea.

PROBLEMS AND FUTURE DIRECTIONS

A lack of nationwide database for epilepsy and epilepsy surgery is a serious impediment not only for heath policy-makers, but also for practicing clinicians. Epilepsy is a chronic disease requiring life-long treatments and care. Currently in Korea, the control of many chronic diseases, such as, cancer, hypertension and dementia is facilitated by nation-wide disease registries and databases. A nation-wide epilepsy database will encourage evidence-based treatment, and facilitate new clinical trials and comprehensive care of patients.

In terms of number of operations, epilepsy surgery accounts for a small part of neurosurgical practice in Korea. The small number of operations prevents young and capable neurosurgeons to participate in this fascinating and important field of clinical practice and research. To overcome this, systematic educational programs are needed, especially for young residents and fellows in neurosurgery.

As mentioned above, neuro-modulation procedures, such as VNS and DBS are currently being actively studied and practiced in Korea. In the near future, we can expect the emergence of other novel neuro-modulation therapies, which may be reversible, effective, versatile, and safe.[8] The roles and cost-effectiveness of these novel procedures should be critically evaluated and compared with traditional medical and surgical therapies.

Although the clinical practice of epileptology is up-to-date in Korea, there is still a relative lack of basic science research of epilepsy in the country. It is known that dentate gyrus is an active site for postnatal neurogenesis.[9] The discovery and culture of neural stem cells have also revolutionized the understanding of the nature and lineage of neuroglia.[10] These findings and other achievement in neuroscience are fundamental in providing further insights into epileptogenesis and developing innovative treatment modalities in epilepsy. Increasing numbers of neurosurgeons in Korea are currently collaborating with other neuroscientists and engaging in basic science research. It is hoped that the young neurosurgeons will also be given more opportunities to communicate with the neuroscientists and participate in neurobiology research.

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