

Executive Summary

Economic outcome analysis about medical and surgical therapies for medically intractable epilepsy

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Background

Epilepsy, which is a disease caused by various factors, occurs through a complex outbreak process and is characterized by recurring epileptic seizures. More than 30% of patients with epilepsy have intractable epileptic seizures that are not controlled despite treatment with two or more drugs. For such intractable epilepsy, surgery is one of the most effective treatment methods. Offering proper treatments for patients with intractable epilepsy can save both patients and society a tremendous amount in long-term medical costs. Therefore, it is now necessary to analyze the current treatment status of patients in South Korea with intractable epilepsy, and to compare and verify the effects of each treatment method. Moreover, it is also necessary to provide fundamental data and supporting evidence on proper treatment methods.

Objective

This study aims to investigate the current treatment status of patients in South Korea with intractable epilepsy and to comparatively analyze the effects of each treatment method. In particular, the present study (1) examines the characteristics of patients in South Korea with epilepsy and intractable epilepsy, (2) compares the effects of the two currently used treatment methods for intractable epilepsy, i.e. surgical and non-surgical

(medication only) treatment, (3) and analyzes the cases of patients with intractable epilepsy that have undergone surgery and compares the effects of each surgical method.

□ **Methods**

I. Data Sources/Subjects

From the national health insurance data from 2002 to 2013, patients (299,235) with epilepsy (G40) or status epilepticus (G41) identified as their chief diagnoses were selected. Among these patients, those (83,253) that were treated with two or more types of anticonvulsants for more than two years and who never stopped their medications for more than six months were defined as patients with intractable epilepsy. Among these patients, those that had epilepsy operations, such as temporal lobectomy, corpus callosotomy, non-temporal lobectomy, and multiple subpial transection, were first selected. Exclusion criteria were applied to this group of patients, and 1,560 surgically treated patients were finalized as our subjects. An exact matching was performed to select the comparative nonsurgical group, based on the characteristics of the surgically treated patients, including their sex, age, health insurance qualification, number of anticonvulsant medication types taken prior to surgery, number of brain wave tests conducted prior to surgery, and whether the patients had encephalopathy. Consequently, 1,443 patients in each of the surgical and nonsurgical groups were matched, and the data collected from the 2,886 patients were used to compare the two groups. The surgically treated patients were again separated based on the type of surgery received into temporal lobectomy and non-temporal lobectomy groups. Each of these groups was divided into two subgroups based on whether or not the patients had received electrode implantation before surgery, to compare the effects of each surgical method.

II. Outcome Indices

Cost-related indices, including the total medical, epilepsy-related medical, and anticonvulsant costs, as well as anticonvulsant

consumption, were selected as the outcome indices of epilepsy treatment methods, due to their economic and clinical significance. The costs were calculated in 2014 values in order to reflect the fluctuations in consumer price indices. Anticonvulsant consumption was calculated as the sum of the DDDs (defined daily dose: average daily dose for each anticonvulsant) by dividing the total six-month consumption of each anticonvulsant by the DDD of the respective anticonvulsant and summing the resulting values together. The number of types of anticonvulsants consumed by the patients ranged between one and 17. The outcome indices were totaled in six-month segments, and we used mean values for each subject.

III. Analysis Methods

Demographic information of the subjects was summarized, and descriptive data were provided to indicate the changes in outcome indices occurring during the time before and after surgery. Generalized estimating equations (GEE) were used to model cost and medication utilization outcomes.

In comparing the surgically and nonsurgically treated patients in the GEE model, whether the patients had surgeries, time, and the interaction between the two were considered; in comparing each surgical method, additional factors, including the type of surgery, time, year, sex, age, and health insurance qualification, were also considered in the model.

□ Results

I. Current Status of Epilepsy Patients

Patients with intractable epilepsy accounted for approximately 35% of the patients with epilepsy investigated in this study. Among these patients, there were slightly more men than women, and the proportions of patients of 50 years of age and older and those below 20 were relatively high. Medical aid beneficiaries accounted for 21.4% of the total epilepsy group and 27% of the patients with intractable epilepsy, and these proportions were significantly higher than that of the Korean total

population (3%). The anticonvulsant medication cost for epilepsy patients steadily increased over time. The anticonvulsant consumption in the patients with intractable epilepsy was approximately 1.5 times higher than that of the general group of patients with epilepsy.

II. Comparison between Surgical and Nonsurgical Treatments

Both surgical and nonsurgical groups spent similar medical costs until 12 months prior to surgery (the mean epilepsy-related medical cost for six months: surgical group, KRW 1,485,897; nonsurgical group, KRW 1,276,474). However, the medical costs in the surgical group rapidly increased at the time of surgery (surgical group, KRW 16,009,867; nonsurgical group, KRW 1,317,113). Their medical costs subsequently decreased to a level lower than that of the nonsurgical group beginning one year after surgery (two years after surgery: surgical group, KRW 1,132,205; nonsurgical group, KRW 1,395,980). A similar trend was observed in anticonvulsant consumption: the consumptions in the two groups were similar one year prior to surgery (surgical group, 345 DDDs; nonsurgical group, 370 DDDs), but the consumption in the surgical group decreased greatly two years after surgery (surgical group, 267 DDDs; nonsurgical group, 361 DDDs). Overall, medical aid beneficiaries paid the highest medical costs in both the nonsurgical and surgical groups, and no notable difference was observed between the three health insurance subgroups (high, middle, and low). Similar trends were observed in the GEE analysis results, which revealed a significant decrease in the surgical group's outcome indices (cost and consumption) from 18 months after surgery (ref = nonsurgical group 12 months before surgeries, $p < 0.05$).

III. Outcome Analysis for Each Surgical Method

Among the patients that had epilepsy surgery, temporal lobectomy was the most frequent operation, at 54.4%. In all surgical methods, the medical costs decreased after surgery. The medical costs decreased as the age of patients increased, and were lower for patients with health

insurance. The costs were significantly higher for patients who underwent electrode implantation, either with temporal lobectomy or with non-temporal lobectomy, than in patients who underwent temporal lobectomy without electrode implantation, and were low in patients who underwent non-temporal lobectomy without electrode implantation. Anticonvulsant consumption increased more in men than in women, and in proportion to the age of patients. Moreover, it was significantly higher in other surgical methods compared with temporal lobectomy without electrode implantation.

Conclusions

In conclusion, the surgical group paid less medical costs after surgery than before, and this trend became more obvious with the passage of time after surgery. Since anticonvulsant consumption in the surgical group rapidly decreased with the passage of time and decreased to a level lower than that in the nonsurgical group, we found that surgery contributed to reducing anticonvulsant consumption by reducing the number of seizures. The medical costs paid by the patients rapidly increased before and after surgery due to the surgeries themselves, and this increase can deter patients from undergoing surgery. Thus, in the future, greater efforts will be needed to demolish the economic barriers present in epilepsy treatments, to encourage patients to receive proper treatment at the appropriate time.

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Key words: epilepsy, intractable epilepsy, cost, surgery, anticonvulsants.