

Outcomes of epilepsy surgery: Initial experiences in Chiang Mai

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Objectives To report our initial experiences using surgical intervention to treat drug resistant epilepsy (DRE).

Methods A retrospective review of DRE patients operated at Maharaj Nakorn Chiang Mai Hospital, Chiang Mai University from 2014 to 2016 was conducted including evaluation of clinical data, surgical outcomes, and complications.

Results Eight patients were operated during the study period, 6 males (75%) and 2 females (25%). The mean age at surgery was 15 years. Most were evaluated as DRE following unsuccessful treatment with a combination of three antiepileptic drugs. After surgery, five patients (62.5%) were free of disabling seizures (Engel class I), and three (37.5%) were almost seizure free (Engel class II). There was only one serious operative complication (memory disturbance) in one patient who underwent an anterior temporal lobectomy.

Conclusion Our initial experience in epilepsy surgery for DRE has shown promising results. A comprehensive epilepsy surgery program should be established including improvement of the associated infrastructure and surgical expertise for the benefits of patients. **Chiang Mai Medical Journal 2018;57(1):27-32.**

Keywords: drug-resistant epilepsy, epilepsy surgery, outcome

Introduction

Epilepsy is a common neurological disorder which affects about 1% of the world's population (1). It has a devastating effect on the quality of life of patients and their caregivers. Although many new antiepileptic medications continue to be developed, 20 to 40% of epilepsy patients are categorized as drug-resistant epilepsy (DRE) (2). DRE is defined as patients who receive an appropriate combination of at least two antiepileptic drugs (AEDs), doses but continue to have ongoing seizures (3).

Epilepsy surgery has become the standard treatment for patients with DRE.

In Thailand, epilepsy surgery has been developed over a period of several decades. Presently, a number of epilepsy surgery centers have been established in Bangkok, the capital city of Thailand. These centers have had a very successful track record in treating several hundreds of patients with DRE (4,5). In the case of regional areas; however, epilepsy surgery is still not fully established, due to insufficient

human and equipment resources. We report on the surgical outcomes and initial experiences in the treatment of DRE patients by epilepsy surgery in Chiang Mai.

Methods

In this retrospective study, we reviewed the medical records of DRE patients operated at Maharaj Nakorn Chiang Mai Hospital, Faculty of Medicine, Chiang Mai University, from 2014 to 2016. Patients with epilepsy caused by various types of intracranial tumors, vascular diseases, e.g., stroke, arteriovenous malformations, and cavernomas, as well as traumatic brain injury were excluded from the study.

Results

The present study included 8 DRE patients (6 males and 2 females). The mean age of seizure onset was 8 years and the mean age at surgery was 15 years. Seizure types were heterogeneous. Most had received at least three types of AEDs.

After discussion about benefits and risks of epilepsy surgery with the patients, their families and caregivers, the patients underwent epilepsy surgery identified as appropriate by the author. Patient characteristics, surgical treatment, and pathological diagnoses are summarized in Table 1.

Illustrative cases

Case 2 (Figure 1)

A 13-year-old-boy with delayed development had been diagnosed with Lennox–Gastaut syndrome (LGS). He had multiple seizure patterns, including atonic seizure (drop attack), since the age of 1 year. He had been treated by a combination of 4 AEDs without significant improvement. He also had multiple episodes of head injury resulting from a drop attack. Cranial magnetic resonance imaging (MRI) showed neither epileptogenic lesions nor structural abnormalities. Interictal scalp electroencephalography (EEG) showed diffuse epileptiform discharges and slow waves without focal EEG onset. He underwent complete corpus callosotomy. Postoperatively, his drop attacks completely disappeared. There was great improvement in his quality of life as noted by both the patient and his caregiver. The patient also gained some improvement in his communication skills.

Case 3 (Figure 2)

An 8-year-old-boy suffering from intractable epilepsy caused by hemimegalencephaly of the left cerebral hemisphere. He had had intractable seizures since birth until the time of surgery. He had right spastic hemiparesis

Table 1. Patient characteristics, surgical treatment, and pathological diagnosis

Patient / Gender	Age at onset (yr)	Age at surgery (yr)	Seizure type	No. of AED	Presurgical evaluation	Clinical diagnosis or epilepsy syndrome	Surgical treatment	Pathological diagnosis
1 (M)	1	9	GTC, DA	3	EEG, MRI	LGS	CC	-
2 (M)	1	13	GTC, DA	4	EEG, MRI	LGS	CC	-
3 (M)	0	8	GTC	4	EEG, MRI	Hemimegalencephaly	FHT	Cortical dysplasia, gliosis
4 (M)	8	21	CPS, GTC	2	EEG, MRI	Bilateral TLE	ATL+AH	MTS
5 (F)	0	9	CPS, GTC	4	EEG, MRI	FLE	FL+CC	Cortical dysplasia
6 (F)	5	7	GTC	3	EEG, MRI	Rasmussen's encephalitis	FHT	Lymphocytic and microglial infiltration
7 (F)	35	37	CPS, GTC	2	EEG, MRI	TLE	ATL+AH	Ganglioglioma
8 (M)	15	17	CPS, GTC	2	EEG, MRI	TLE	SAH	DNT

-, none; AH; amygdalohippocampectomy, ATL; anterior temporal lobectomy, CC; corpus callosotomy, CPS; complex partial seizure, DA; drop attack, DNT; dysembryoplastic neuroepithelial tumor, EEG; scalp electroencephalography, FHT; functional hemispherectomy, FL; frontal lobectomy, FLE; frontal lobe epilepsy, GTC; generalized tonic–clonic seizure, LGS; Lennox–Gastaut syndrome, MRI; magnetic resonance imaging, MTS' mesial temporal sclerosis, RE; Rasmussen's encephalitis; SAH; selective amygdalohippocampectomy, TLE; temporal lobe epilepsy, yr; year

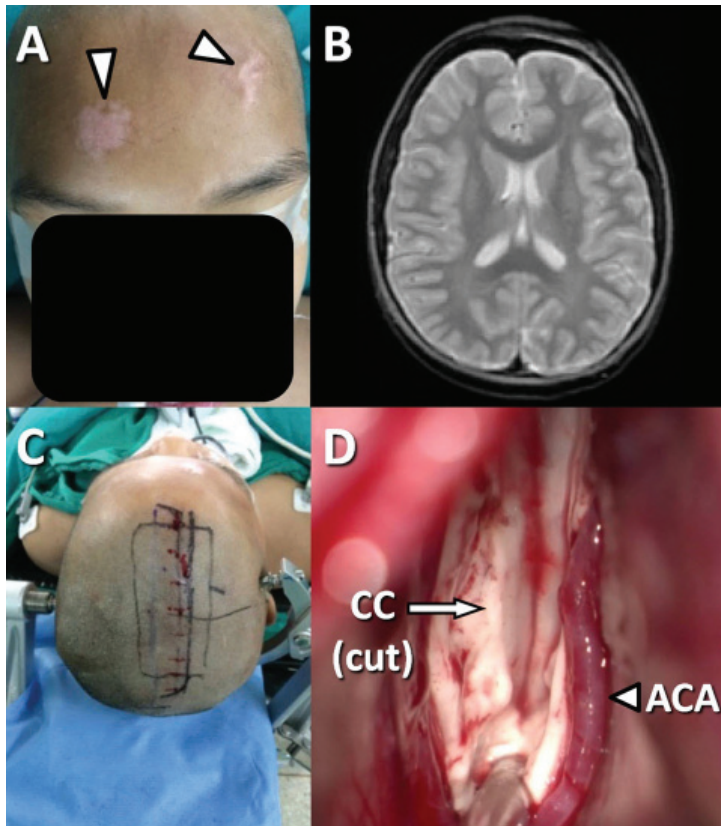


Figure 1. A patient with LGS undergoing corpus callosotomy. (A) Evidence of multiple episodes of head injury (arrows) resulting from drop attack. (B) Cranial MRI shows no focal abnormality. (C) Skin incision and craniotomy plan for corpus callosotomy. (D) Microsurgical view of the corpus callosotomy showing the resected corpus callosum (CC) and the adjacent anterior cerebral artery (ACA).

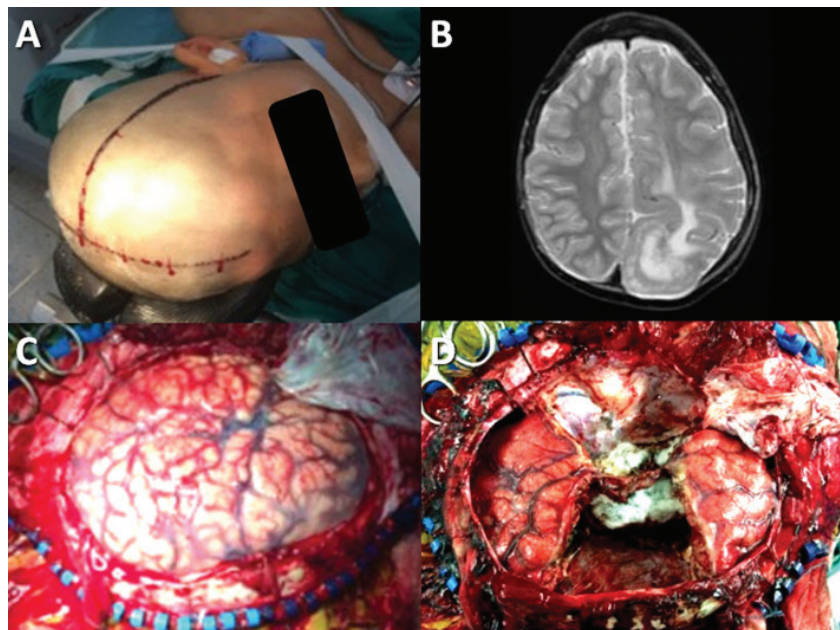


Figure 2. Patient with left hemimegalencephaly undergoing functional hemispherectomy. (A) Plan of surgical incision and patient position for the operation. (B) Cranial MRI showing abnormal gyri of the left cerebral hemisphere, especially in the parieto-occipital region. (C) Operative exposure after craniotomy for functional hemispherectomy showing abnormal enlarged gyri of the left cerebral hemisphere. (D) After a multi-step operation, including temporal lobectomy, frontoparietal (central cortex) resection, frontal lobe disconnection, parieto-occipital disconnection, transventricular corpus callosotomy, and insular cortex aspiration.

and as well as delayed development. The patient had been given a combination of 4 AEDs; however, he still had seizures more than 30 to 40 times per day. After extensive discussion with his parents about the risk of worsening the hemiparesis and the potential benefits of surgery, he underwent left functional hemispherectomy. Seizure control was achieved after the operation (Engel class I).

The result of surgical treatment was assessed using the Engel Epilepsy Outcome Scale (Table 2) (6). Surgical outcome and complications of all 8 patients are shown in Table 3.

Discussion

Epilepsy is a common chronic neurological disorder. Almost one-third of epilepsy patients are DRE (7). DRE has a tremendous serious negative impact on several activities of the patient, including routine personal daily chores, education, work, and social activities interactions. It also results in a significant burden on

caregivers. DRE patients also have an increased risk of injury, depression, suicide, and sudden unexpected death in epilepsy (SUDEP) (8). The administration of multiple AEDs without achieving successful control of epilepsy represents a significant public medical budget expenditure.

Epilepsy surgery is now accepted as the standard treatment for DRE. Its efficacy in controlling DRE is far better than treatment with medication alone (9, 10), and advances in operative techniques and equipment continue to be achieved. This report describes our initial experiences in regards to with epilepsy surgery in Chiang Mai, a major province in the northern region of Thailand and the country's second largest city. Due to the small number of patients and the relatively short follow-up period, it is not possible to conduct any statistical analysis or to reach definitive conclusions. However, we feel that the promising results we have obtained in our initial experience are of value.

Table 2. Engel Epilepsy Surgery Outcome Scale (6)

Class	Definition
I	Free of disabling seizures Completely seizure-free since surgery, nondisabling simple partial seizures after surgery but completely seizure-free for at least 2 years, and convulsions only when medications are withdrawn.
II	Rare disabling seizures ("almost seizure-free") Initially seizure-free but has disabling seizures now, disabling seizures rare since surgery, seizures more than rare after surgery but now no rare seizures for at least 2 years, nocturnal seizures only.
III	Worthwhile improvement Worthwhile seizure reduction or prolonged seizure-free intervals amounting to half the follow-up period, but not less than 2 years.
IV	No worthwhile improvement No significant seizure reduction, no appreciable change or seizures getting worse.

Table 3. Surgical outcomes and complications

Patient	Engel Outcome Scale	Details of Improvement	Complications
1	II	No drop attack	-
2	II	No drop attack	-
3	I	Improved caregiver satisfaction	-
4	I	Improved caregiver satisfaction	Worsening of memory
5	I	Improved language and learning ability	-
6	I	Improved caregiver satisfaction	-
7	I	Return to work	-
8	II	Return to work	-

- none

The majority of DRE cases are the result of temporal lobe epilepsy (TLE) caused by hippocampal sclerosis (HS). This report, however, includes only three cases of HS which is a reflection of the lack of effective recruitment of surgical candidates for epilepsy surgery. In case IV, the patient had bilateral HS. We did not use the Wada test with this case to lateralize the cerebral hemisphere for speech and memory representation. Rather, we decided to proceed with a right standard anterior temporal lobectomy and amygdalohippocampectomy based only on interictal EEG and MRI appearance. After the operation, the patient's short-term memory declined. The other three patients were pediatric cases with intractable epilepsy and delayed development caused by a variety of epileptic disorders including LGS, cortical dysplasia, hemimegalencephaly, and Rasmussen's encephalitis. Operative procedures for this group of patients involved primarily disconnective surgery such as corpus callosotomy and functional hemispherectomy. In all three cases, seizures were dramatically reduced without complications. Caregivers were also satisfied with the outcomes. Some of the patients also showed improvement in cognitive abilities and language skills.

The present study demonstrates the potential of surgical treatment of DRE patients in regional hospitals. Epilepsy surgery should not be considered as the "last resort" treatment for epilepsy. Early surgery increases the overall benefits for patients. Many DRE patients with focal onset seizure are able to become seizure-free after surgery. In Thailand, most epilepsy patients are treated at primary and secondary hospitals. This results in significant delay in treatment for many potential epilepsy surgery candidates or even cause them to miss the opportunity for surgery entirely. A comprehensive epilepsy surgery program needs to be established to improve the capability of the medical system to treat DRE patients in the northern region areas outside the capital city of Thailand. That includes recruitment of teams of multidisciplinary experts in epilepsy including an as well as an increase

in the size of medical staffs. In terms of infrastructure, a systematic presurgical evaluation system needs to be established, this include long-term video electroencephalography (vEEG), high resolution MRI, single photon emission computerized tomography (SPECT), positron emission tomography (PET), etc. In addition, efforts should be made to increase public awareness of epilepsy surgery. One key step is the establishment of a referral system for DRE patients. It is hoped that this initial experience will lead to improvement advances in the technical ability and surgical expertise in the treatment of the more complicated DRE patients.

Conclusions

Epilepsy surgery is currently under-utilized, especially in the regional areas of Thailand areas outside metropolitan Bangkok. We are still far from establishing a standard comprehensive epilepsy surgery program. Both additional multidisciplinary teams and infrastructure are needed. Identification of more suitable surgical candidates could be achieved by promoting publicizing the potential of epilepsy surgery both among medical staffs as well as among the public, including establishment of a referral system for DRE patients in the northern region of Thailand.

Ethics

This study was exempted from review by the research ethics in humans by the Ethics Committee, Faculty of Medicine, Chiang Mai University.

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Conflicts of interest

There are no conflicts of interest.

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ผลลัพธ์ของการผ่าตัดโรคลมชัก: ประสิทธิภาพของเชียงใหม่

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หน่วยประสาทศัลยศาสตร์ ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

วัตถุประสงค์ ศึกษาผลลัพธ์ของการผ่าตัดโรคลมชักในผู้ป่วยโรคลมชักดื้อยา

วิธีการศึกษา เป็นการศึกษาย้อนหลังในผู้ป่วยโรคลมชักดื้อยาและได้รับการรักษาด้วยการผ่าตัดโรคลมชักที่โรงพยาบาลมหาราชนครเชียงใหม่ มหาวิทยาลัยเชียงใหม่ ในช่วงปี พ.ศ. 2557 ถึง พ.ศ. 2559 โดยทำการวิเคราะห์ลักษณะทางคลินิก ผลลัพธ์การรักษา และภาวะแทรกซ้อน

ผลการศึกษา ผู้ป่วยจำนวน 8 ราย ได้รับการวินิจฉัยเป็นโรคลมชักดื้อยาและได้รับการผ่าตัดโรคลมชัก แบ่งออกเป็นเพศชาย 6 ราย (ร้อยละ 75) เพศหญิง 2 ราย (ร้อยละ 25) อายุเฉลี่ยขณะได้รับการผ่าตัดเท่ากับ 15 ปี ผู้ป่วยส่วนใหญ่ได้รับยากันชักอย่างน้อย 3 ชนิด ผลการผ่าตัดพบว่าผู้ป่วย 5 ราย (ร้อยละ 62.5) ไม่มีอาการชัก (Engel ระดับ I) และผู้ป่วย 3 ราย (ร้อยละ 37.5) มีอาการชักเหลือเพียงเล็กน้อย (Engel ระดับ II) พบภาวะแทรกซ้อนที่เกี่ยวข้องกับความจำในผู้ป่วย 1 ราย ซึ่งได้รับการผ่าตัด temporal lobe ส่วนหน้า

สรุปผลการศึกษา การผ่าตัดโรคลมชักที่โรงพยาบาลมหาราชนครเชียงใหม่ได้ผลลัพธ์ที่ดี จึงควรมีการจัดตั้งทีมสหสาขาวิชาชีพที่มีความเชี่ยวชาญโรคลมชักโดยเฉพาะ รวมทั้งพัฒนาด้านโครงสร้างพื้นฐานและความเชี่ยวชาญเพื่อประโยชน์ต่อการรักษาผู้ป่วยโรคลมชัก *เชียงใหม่เวชสาร* 2561;57(1):27-32.

คำสำคัญ: โรคลมชักดื้อยา การผ่าตัดโรคลมชัก ผลลัพธ์