Epilepsy surgery for mesial temporal sclerosis: Report of four cases seizure-free after surgery

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Abstract

Epilepsy is a serious disease affecting people of all ages, races and socioeconomic backgrounds. It is the second most common cause of mental health disability. Despite treatment with antiepileptic drugs, 40% of the patients are resistant to treatment and suffer from chronic epilepsy, long term disability and premature death (SUDEP). The most common cause of these drug-resistant epilepsies is temporal lobe epilepsy related to mesial sclerosis.

It has been demonstrated through randomized clinical trials that surgery may render a good proportion of these patients seizure-free. But, patients should undergo a non-invasive, yet specific, pre-surgical evaluation to achieve the best results from surgery.

The aim of this article was to demonstrate the Albanian experience with four cases, inviting health care professionals to consider surgery as an option for their drug-resistant patients.

Keywords: epilepsy, sclerosis, surgery.

Introduction

Epilepsy is a serious disease affecting approximately 1% of the population. It affects people of all ages, races and socioeconomic backgrounds and it is the second most common cause of mental health disability, particularly among young adults (1). Its burden of illness is similar to that of breast cancer in women and lung cancer in men (2).

Despite medical treatment with antiepileptic drugs (AED), 40% of patients are resistant to antiepileptic medication (3). Resistant epilepsy is defined as failure of adequate trials of two tolerated, appropriately chosen and used antiepileptic drug schedules (whether as monotherapies, or in combination) to achieve a sustained seizure-free state (4). Temporal lobe epilepsy (TLE) is the most common form of epilepsy (5) and the most likely to be medically resistant to treatment. Seizures in temporal lobe may occur as simple partial seizures with preserved awareness or as complex partial seizures. Secondary generalization occurs in a substantial number of patients.

Drug resistant patients that continue to experience disabling seizures have reduced quality of life, cognitive impairment, a higher risk for sudden unexpected death, anxiety and depression. Randomized clinical trials and large observational studies have shown that surgery of temporal lobe is an alternative that should be considered as early as possible for these patients.

Methods

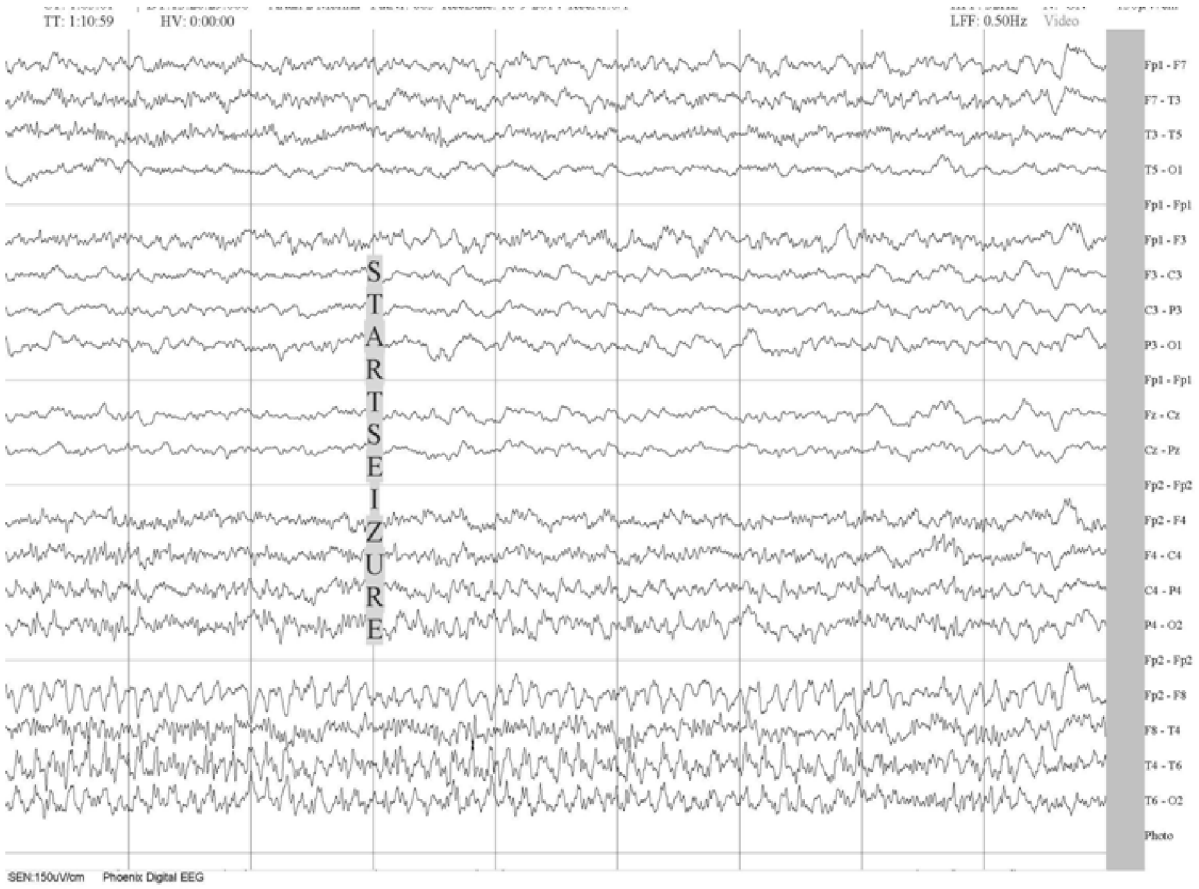
In our institution, namely "Mother Theresa" University Hospital Center in Tirana, four patients (three adults and one child) with drug resistant temporal lobe epilepsy from mesial sclerosis underwent surgery. Patients had a follow up of at least one year. In our service, all patients referred for a pre-surgical evaluation were admitted at the hospital for a thorough clinical evaluation, a detailed history of previous AED trials, classification of the epilepsy syndrome and modification of treatment in accordance to the seizure type.

Video recordings of several seizures taken by the family members were also used to characterize the semiology of the seizures (5,6). These patients had been considered drug-resistant after evaluation of the past antiepileptic drug regimens and after trials of antiepileptic drugs in accordance to the ILAE definition of drug resistance (4).

Video-EEG monitoring

Patients underwent an inpatient video-EEG monitoring 1-3 days after reduction of AED regimen. Cup electrodes were fixed in the scalp with collodion according to the 10-20 montage using tape measurement. The head was wrapped and registration was carried under the supervision of EEG technologist. Interictal recording and several hyperventilations and intermittent photic stimulations were evaluated for background abnormalities or interictal epileptiform discharges. These were considered focal when they were present in 1-2 adjacent electrodes and demonstrating phase-reversal. Three to five seizures were recorded and inspected thoroughly with synchronized video-EEG. Description of ictal events was performed according to a standard descriptive terminology (7) and was correlated to EEG abnormalities. Temporal foci were classified as anterior temporal when they involved the F7/F8 electrode or T1/T2 electrodes. Rhythmic theta of > 5 Hz pattern over the temporal lobe was considered a characteristic pattern associated with mesial temporal seizures (Figure 1) (8).

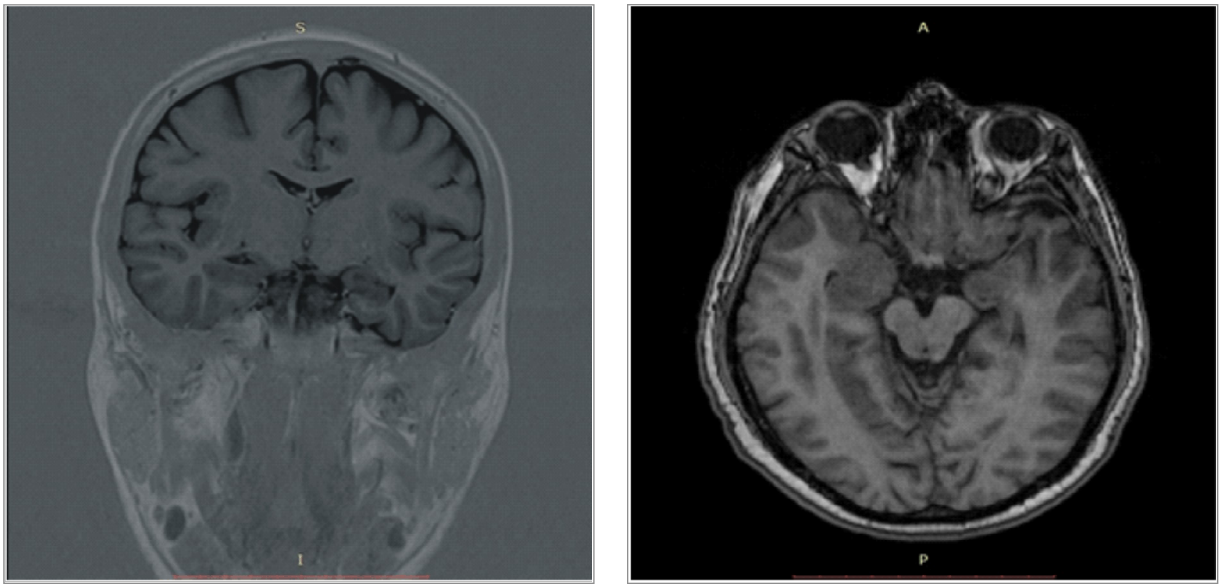
Figure 1. Ictal EEG showing a 7 Hz, theta activity over the right anterior temporal lobe at the onset of seizure



Neuroradiological evaluation

The patients underwent brain 1.5 Tesla magnetic resonance imaging (MRI) examination according to epilepsy protocol. Sequences of T1WI, T2WI, axial and coronal FLAIR, axial 3D T1 iso, sagittal T1, T1 IR, orientated perpendicular to the long axis of the hippocampus were visually inspected by an experienced neuroradiologist. Hippocampal atrophy, increased signal in T2/FLAIR images, fornix asymmetry, temporal horn dilatation, blurring of the grey-white matter margin were considered as imaging features of a hippocampal sclerosis (Figure 2) (9).

Figure 2. Preoperative MRI scans in axial and coronal showing left Ammon's horn atrophy and adjacent ipsilateral temporal neocortex atrophy



Description of the patients

Table 1 presents the pre-surgical characteristics of the patients included in this study.

Table 1. Pre-surgical characteristics of the patients

Patient	EK	AM	LB	EL
Age	42	36	38	8
Sex	M	M	M	M
Risk factors	FS	FS	FS	FS
Epilepsy onset (age)	12	18	1.5	2.5
Epilepsy duration (years)	30	18	37	6
Frequency of seizures no/month	12	5	7	5
Failed AED trials	PHT, CBZ, PHB, LTG, LEV	PHB, VPA, CBZ	PHB, TPX, VPA, CBZ, LEV	PHB, CBZ, CLB, VPA, LEV
Aura	rising thoracic compresion, fear	epigastric aura	epigastric aura	-
Ictal symptoms	L hand automatisms, oroalimentary automatisms, R immobile arm, L head turning	R hand automatisms, L immobile arm, R head turning, R hand nosewiping	R hand dystonic posturing, oroalimentary automatisms, L hand automatisms, L hand nosewiping	vocalisation, R arm distonic posturing, L hand automatisms, periictal drinking, rare generalisation
Interictal EEG	L anterior temporal focal slowing, focal spike waves	R anterior temporal focal spikes	L anterio temporal focal slowing, focal spike waves	L anterior tempora focal slowing, mid temporal focal spike waves

Patient	EK	AM	LB	EL
Ictal EEG	6 Hz theta activity over F7	7 Hz theta activity over F8	7 Hz theta activity over F7	5 Hz theta activity over F7
MRI	FLAIR increased signal of L hippocampus, atrophy, dilated lateral horn of ventricle, fornix atrophy	R hippocampal atrophy, temporal horn dilatation, fornix atophy	L hipocampal atrophy, entorhinal cortex and temporal gyrus atrophy, formix asymmetry	L hipocampal atrophy, entorhina cortex and temporal gyrus atrophy, formix asymmetry, hypotrophy of L temporal lobe

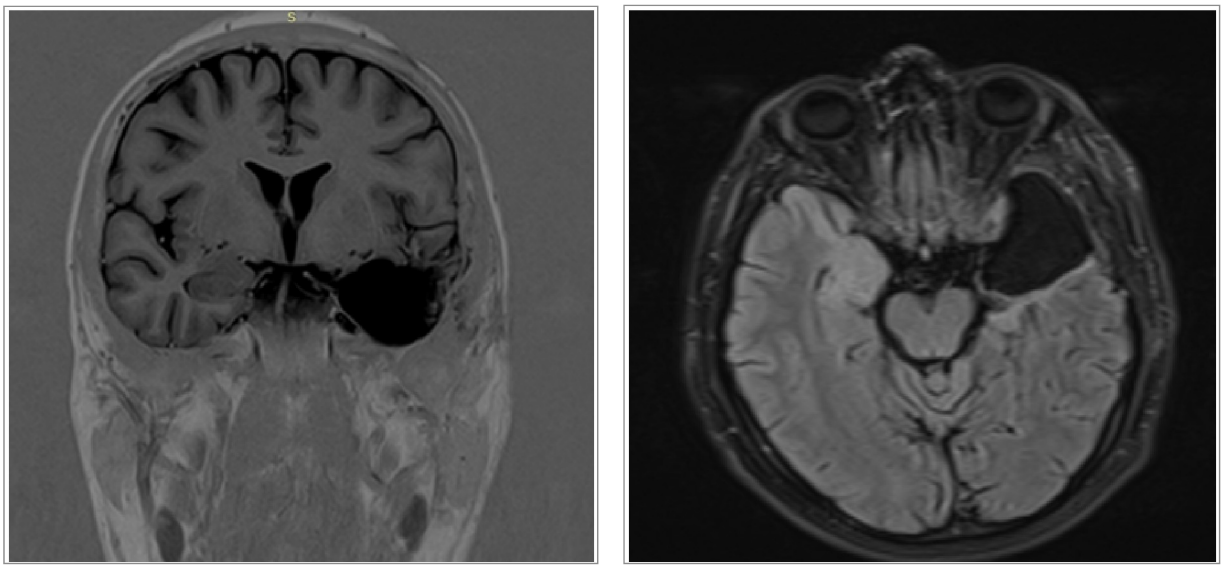
Table abbreviations: FS=febrile seizures, PHT=phenytoin, PHB=phenobarbital, CBZ=carbamazepine, LTG=lamotrigine, VPA=sodium valproate, TPX=topamax, LEV=levetiracetam, L=left, R=right.

Neuropsychological and psychiatric evaluation
It was performed in all patients and included a battery of tests that included intelligence, general verbal and visuospatial ability, verbal memory, visuo-spatial memory and executive function (10). Psychiatric evaluation was performed for evaluating presurgical anxiety, depression or psychosis.

Multidisiplinary conference
All patients were discussed in our institution, in a multidisiplinary conference involving neurosurgeons, epileptologists, neuroradiologists, neuropsychologist for evaluation of the congruence of clinical, imaging and electroencephalographic data. When these data were congruent to the medial structures of the temporal lobe and lateralized to a single lobe, surgery was proposed to patients.

Surgery
Anterior temporal lobectomy was performed by epilepsy neurosurgeons. It consisted of removal of amygdalo-hippocampal complex and anterior part of lateral temporal neocortex sparing the superior temporal gyrus (on the left), for preservation of language (11). Surgery was uneventful and the patients were discharged within 5-7 days. Postoperative MRI was performed within two months (Figure 3).

Figure 3. Postoperative coronal and axial MRI scans showing resection of mesial and part of lateral structures of the temporal lobe



Seizure outcome assessment

Engel classification of postoperative seizure outcome is used to assess postoperative seizure outcome (12). The patients were followed up with scheduled visits and antiepileptic treatment was held constant for six months. AED was tapered off in patients with no clinical seizures and normal EEG at six months postoperatively.

Results

All four patients presented a previous antecedent of febrile convulsions at an early age and developed subsequent epilepsy with complex partial features. They all presented with a characteristic aura of rising epigastric sensations, thoracic constriction, followed by an alteration of consciousness, ipsilateral manual automatisms, contra-lateral dystonic arm or immobile limb, oro-alimentary automatisms and rare secondary generalizations. Ictal EEG demonstrated in all cases an evolving rhythmic pattern of >5 Hz theta activity involving the anterior temporal electrodes. These patients presented with imaging features of hippocampal atrophy and two of them with additional atrophy of immediate adjacent structures of the temporal lobe.

At one year follow-up, three out of four patients remained seizure free (Engel class Ia). One patient, the pediatric case, experienced only auras postoperatively with no loss of consciousness (Engel class Ib). He was free of disabling seizures. No postoperative neurological complication occurred. The patients did not present any clinically evident neuropsychological disability during the follow-up period.

Discussion

Temporal lobe epilepsy is the most frequent among focal epilepsies. It is often resistant to medical treatment. Mesial temporal sclerosis is the most frequent pathological substrate. It is a highly epileptogenic lesion that affects a constant region of the brain, namely the hippocampus and the immediately adjacent cortex, giving rise to a relatively uniform clinical syndrome of epigastric aura, fear, experiential phenomena (déjà vu, dreamlike experiences), tonic posturing of the arm, oro-alimentary automatisms and rare secondary generalizations. A substantial number of patients have a history of complicated febrile convulsions.

A detailed description and visual inspection of clinical events, giving emphasis to the earliest symptoms, before alteration of consciousness, is highly correlated to the ictal onset zone.

In such drug-resistant cases a pre-surgical clinical evaluation is important to select patients that most likely will be treated surgically. High suspicion of temporal lobe epilepsy from clinical features and EEG warrants a specific MRI protocol evaluation with an experienced neuro-radiologist. Standard MRI evaluation certainly rules out large lesions like tumors or other lesion but it will miss asymmetries of certain structures of the brain suggesting temporal atrophy (13,14). These latter findings are most likely revealed by an epilepsy protocol MRI. Video electroencephalography is important to define an irritative zone that is correlated with clinical events and imaging studies.

Surgery with anterior temporal lobectomy (ATL) is the most common surgical procedures performed worldwide (59% of patients) for treating temporal lobe epilepsy patients. Two randomized clinical trials have evaluated the role of surgery in temporal lobe epilepsy. They showed that surgical therapy is more effective than medical treatment for medically refractory epilepsy. At one year, 58% of the patients treated surgically were seizure-free compared with 8% of the patients treated medically (15). Mesial temporal sclerosis cases comprised 70% of the overall patients. In the second study, in patients with mesial temporal lobe epilepsy who were treated surgically early after diagnosis (within two years of developing medically refractory epilepsy), a seizure-free state was achieved in 73% of them compared with none of the patients treated medically after two years of follow-up (16).

In the pediatric population, 78% with epilepsy from

mesial temporal sclerosis attained a seizure-free state after anterior temporal lobectomy (17). A practice parameter produced by the American Academy of Neurology recommended surgery as the treatment of choice for this type of epilepsy. Nevertheless, surgical treatment for epilepsy remains still an underused accepted therapeutic intervention (18).

With a good anatomic-electro-clinical correlation after a non-invasive diagnostic evaluation, it is possible to treat surgically and effectively patients with refractory temporal lobe epilepsy. Surgery is a safe technique for the experienced hands of an epilepsy neurosurgeon. Its complications are minor or temporary as they tend to resolve completely (19). Consequently, early identification of drug-resistance should prompt referral to a pre-surgical evaluation that will select candidates for surgery of epilepsy and avoid irreversible disability.

Conflicts of interest: None declared.

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