

## Original Article

# Surgical and neurological complications in temporal lobe epilepsy surgery in modern era

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## Abstract

**Background:** Temporal lobe epilepsy is the most common form of focal epilepsy, and surgical treatment has been proven to be an effective and safe management. Despite its safety, it is important to know that some complications and/or even death can be seen after surgery. Neurosurgeons should be able to precisely inform epilepsy surgery candidates about the possible unwanted/unexpected conditions after surgery.

**Methods:** Fifty-three patients who underwent anterior temporal lobe resection due to temporal lobe epilepsy by a single surgeon were investigated retrospectively regarding postoperative surgical and neurological complications.

**Results:** Overall complication rate was found to be 19%, surgical complications comprised 13.2% whereas neurological complications were 5.8%. Three patients underwent a second surgery whereas the rest had medical treatment or recovered spontaneously. Fortunately persistent complication rate was found to be 0%, and there was no mortality.

**Conclusions:** Anterior temporal lobe resection is a safe and very effective surgical modality for the treatment of temporal lobe epilepsy. However, unexpected complications may be possible in this modern era and a surgeon should trust in him/herself not in modern equipments.

**Key Words:** Surgical complication, epilepsy, surgery, temporal lobe

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## INTRODUCTION

Temporal lobe epilepsy (TLE) is the most common form of focal epilepsy, and surgical treatment has been proven to be an effective and safe management.<sup>[1,5-7]</sup> Although several surgical techniques have been reported in TLE, the most commonly performed surgical approaches include cortico-amygdalo-hippocampectomy (CAH), also known as anterior temporal lobectomy (ATL) and selective amygdalohippocampectomy (SelAH). Surgical technique of both procedures has been well-defined in the literature.<sup>[6]</sup> Long-term favorable (Engel Class I and II) seizure outcomes

after surgery for TLE were reported to be 82% and 90% in CAH and SelAH, respectively.<sup>[8]</sup> When the patients are

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offered an elective surgery for their disease, they would certainly like to know how severe the consequences can be and if there is a risk of persistent neurological sequelae or what is the percentage of mortality.

In the literature, there have been several reports mentioning the complications of epilepsy surgery including the ones performed in different epilepsy disorders,<sup>[2,7]</sup> complications of both CAH and SeLAH,<sup>[5]</sup> and complications of only SeLAH.<sup>[10]</sup> In this report, we aimed to report the complications of CAH procedures only carried out by a single surgeon in one institution to be able to create a more homogeneous patient population.

## MATERIALS AND METHODS

### Patients

We retrospectively analyzed the complications seen after 53 CAH procedures done by the senior author (TT) between November 2009 and January 2017 in TLE patients older than 18 years of age who were followed up for at least 12 months. A multidisciplinary team evaluated standardized presurgical data consisting of neurological, neuropsychological and psychiatric examinations, ictal and interictal scalp video electroencephalograms (EEG), brain magnetic resonance imaging (MRI), interictal positron emission tomography (PET), and invasive EEG [stereoelectroencephalography (SEEG)], if needed. Patients who were thought to benefit from surgery were offered to have CAH. We reviewed all the included patients' files and postoperative brain MRIs. The parameters included age at surgery, gender, side of operation, use of SEEG, and surgical and neurological complications.

### Classification of complications

Although there is no universal definition of complication after TLE surgery, complication is defined in the literature as an unwanted, unexpected, and uncommon event after a surgical procedure.<sup>[7]</sup> Here, we used a five graded severity scale which has been defined in the literature as follows:<sup>[5,11]</sup> Grade 0: no complication; Grade 1: a transient complication not needing treatment or noninvalidating homonymous contralateral superior quadrantanopia; Grade 2: a transient complication that resolved completely but required surgical or medical treatment; Grade 3: a persistent neurological or visual deficit that affected daily activities for more than 6 months; and Grade 4: death linked to the surgery.

### Statistical analysis

We used a commercially available statistical software package (SPSS version 22.0 Inc., Chicago, IL, USA) for all statistical analyses. The mean  $\pm$  SD was calculated for appropriate parameters.

## RESULTS

### Patient demographics

This analysis was based on 53 patients with drug-resistant TLE who underwent CAH (ATL). Their mean age at surgery was  $30.4 \pm 9.0$  (range, 19–55 years) and the male/female ratio was 1.04. Thirty-four patients (64%) were operated on the left side and 19 (36%) on the right side. Ten patients (18.8%) underwent SEEG, 7 of which had depth electrodes, while 3 underwent subdural grid/strip [Table 1]. Histopathologic examinations showed hippocampal sclerosis in all, and has not been discussed extensively here as it is not related to the aim of the study.

### Overall complications

Recovery from surgery was uneventful in 43 patients (81%). The complications of 10 patients are summarized in Table 2 and Figure 1 (19%). According to the grading scale described above, 6 patients (11.3%) had grade 1 complication and 4 patients (7.5%) had grade 2 complication, while the rest (81.2%) had grade 0 complication. There were neither persistent complications (grade 3) nor death after surgery [Figure 2]. A further surgical intervention was needed for 3 patients due to complications (5.6%) [Table 1].

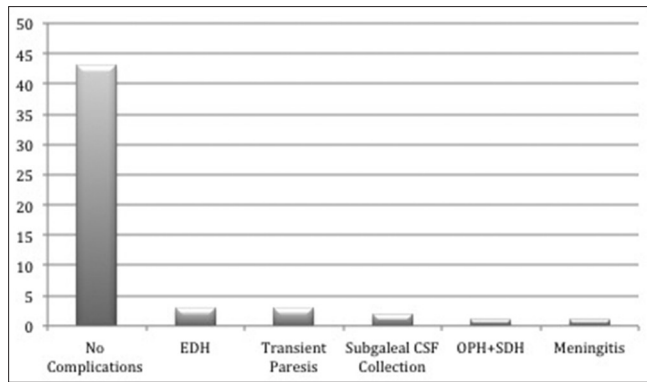
**Table 1: Demographic characteristics of the patients**

Parameter	Number (%)
Gender	
Female	26 (49)
Male	27 (51)
Side of resection	
Right	19 (36)
Left	34 (64)
Invasive Electrode	10 (19)
Subdural grid/strip	3 (5.8)
Depth electrode	7 (13.2)
Complications	10 (19)
Surgical	7 (13.2)
Neurological	3 (5.8)

**Table 2: The distribution of surgical and neurological complications**

Complications	Number (%)	Surgery	Invasive electrode	Grade
Surgical	7 (13.3)			
EDH	3 (5.7)	2	1	1-2
CSF collection*	2 (3.8)	2	0	2
SDH**	1 (1.9)	1	0	2
Meningitis	1 (1.9)	1	0	2
Neurological	3 (5.7)			
Paresis***	3 (5.7)			1
Total		10 (19)		

EDH: Epidural hematoma; Grading was described in Methods; \*Subgaleal cerebrospinal fluid collection; \*\*Subdural hematoma together with hematoma within the resection cavity; \*\*\*Transient paresis



**Figure 1: Distribution of the complications**

### Surgical complications

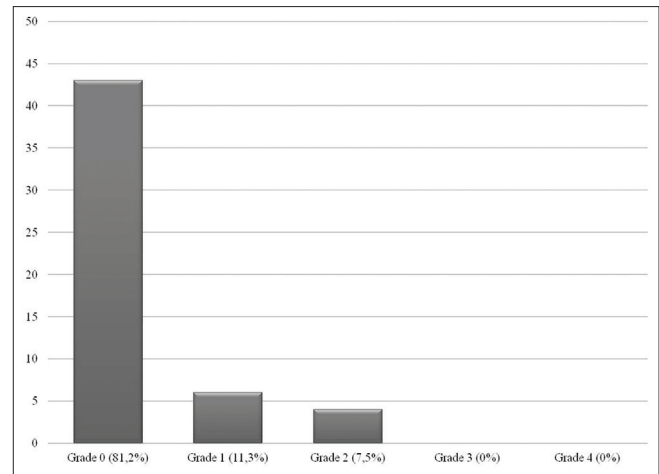
Seven (13.2%) of the 10 complications were directly related to surgery. They consisted of 3 epidural hematomas (EDH), 1 hematoma within the resection cavity together with subdural hematoma (SDH), 2 subgaleal cerebrospinal fluid (CSF) collections, and 1 meningitis. The one with hematoma within the resection cavity and 1 of the 3 EDHs were surgically evacuated immediately after the first surgery. One EDH was only clinically observed without a need for surgical intervention, whereas the last one was diagnosed 1 week after discharge. There were no depth electrode or subdural grid-related complications.

The patient with delayed EDH was a 27-year-old man. He was admitted with fever and headache 1 week after discharge. Cranial MRI was performed and a contrast-enhancing epidural collection was seen. The contrast enhancement was thought to be related to epidural empyema. Fortunately, no obvious pus was observed during surgery, and there was no sign of infection that was proven by microbiological cultures. The postoperative period was uneventful and he was discharged without any neurological deficit.

The one with hematoma within the resection cavity together with SDH was a 41-year-old male who had sudden worsening in neurological status (Glasgow coma scale: 9/15) 6 hours after the surgery. The patient was urgently taken to the operating room following CT scan, and the hematoma was evacuated successfully. He recovered completely 24 hours after the second surgery and was discharged from the hospital without neurological sequelae.

Two patients with subgaleal CSF collections did not have leakage through the skin and collections were withdrawn percutaneously without surgical intervention.

A 42-year-old male was readmitted to our clinic with fever, nuchal stiffness, and vomiting 1 week after discharge, and 10 days of treatment with appropriate intravenous (IV) antibiotics was sufficient to cure the infection. All the surgical complications recovered without any persistent sequelae.



**Figure 2: Grading of complications according to the grading scale described within the manuscript**

### Neurological complications

Three patients (5.6%) showed neurological complications. Two patients had transient hemiparesis and 1 had only mild transient paresis of her foot. Diffusion tensor MRI sequences of both patients with hemiparesis showed diffusion restriction on the posterior limbs of internal capsules ipsilateral to the lesions, whereas there was a middle cerebral artery territory infarction in the patient with monoparesis. Overall, they typically showed marked recovery within the first 48 hours postoperatively. Transient hemiparesis seems to be related to anterior choroidal artery vasospasm due to surgical manipulation which was reported before.<sup>[3]</sup> On their 3<sup>rd</sup> month outpatient visit, they all had full muscle strength and none had persistent sequelae. All 3 neurological complications were graded as grade 1 complication [Table 2].

### DISCUSSION

As it is well described that epilepsy surgery for TLE is very effective in seizure control, greatly increasing long-term quality of life and lowering medication use,<sup>[7-9]</sup> TLE patients should be advised to have temporal lobe surgery. That is why we should know the morbidity and/or mortality rates when offering a surgical procedure to patients. Although surgical modalities have been improved in the modern era, there are still unpreventable complications related to the surgical process itself. While most of the authors reported no mortality, it may reach up to 3.5% very rarely.<sup>[4]</sup> The neurological and surgical complications excluding visual field defects and neuropsychological disorders after ATL ranged between 0% and 16%.<sup>[1]</sup> The most striking feature that we noticed in our literature review was that there was no consensus on how to classify complications related to epilepsy surgery. Complications were classified as transient or permanent by Gooneratne *et al.*,<sup>[2]</sup> as major or minor by Mathon *et al.*,<sup>[5]</sup> and as minor (transient) or major (permanent) by Tanriverdi *et al.*<sup>[7]</sup> Further, we noted

that definitions of major/minor and transient/permanent varied according to the author and a universal scale is neither defined nor used to classify the complications. Mathon *et al.*<sup>[5]</sup> used the grading scale defined by Wellmer *et al.* in their cohort.<sup>[5,11]</sup> This scale seems an objective one to grade the complications secondary to epilepsy surgery and may be used to standardize and compare various authors' complications.

Tanriverdi *et al.*<sup>[7]</sup> reported 1.7% of surgical and 1.1% of neurological complications after temporal resection procedures.<sup>[7]</sup> Mathon *et al.*<sup>[5]</sup> reported 1.8% of surgical and 3.9% of neurological complications in their series in which persistent neurological sequelae was 0.5%.<sup>[5]</sup> Gooneratne *et al.* reported 6.3% of surgical and 17.7% of total neurological complications, of which 16.4% had persistent neurological deficits.<sup>[2]</sup>

Our results concerning the complication rates are in line with the previous series revealing that surgery for TLE is a safe treatment. However, unexpected complications such as vasospasm due to manipulation, as seen in one of our cases, or direct surgical injury to anterior choroidal artery during uncus and amygdala resection can occur. Despite the availability of modern surgical equipment, serious complications are still possible and patients should be informed about such complications by the epilepsy team before surgery.

### Limitations

This report has some limitations. First, this is a retrospective data analysis which can cause bias. Second, limited number of patients were included. This report did not provide information about neuropsychological and seizure outcomes as the aim of this short report was to focus on complications directly related to surgery. We did not evaluate the postoperative visual field deficits of patients since it is reported as an expected finding in ATL.<sup>[2,7]</sup>

### CONCLUSION

The results of this short report underlines that, although surgery for TLE can be safe when performed by experienced surgeons, unexpected complications are still possible. Thus, these risks should be explained to patients before surgery. More importantly, neurosurgeons should not trust in modern equipment entirely during

surgery, instead the only thing that an epilepsy surgeon should trust must be him/herself.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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