

Surgical Management of Epilepsy and Outcomes in a Comprehensive Epilepsy Center in Pakistan: A 20-year Retrospective Analysis

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Abstract

Background: Epilepsy is a prevalent neurological disorder in Pakistan, with an early onset in a substantial portion of the population. Surgical intervention for drug-resistant epilepsy is a viable treatment option, yet it remains underutilized due to limited specialized centers and societal stigmas.

Objectives: Our study evaluated the outcomes of epilepsy surgeries performed over two decades in a major Pakistani hospital.

Methodology: A 20-year retrospective cohort study was conducted from 2002 to 2022, involving 31 patients with focal epilepsy who underwent surgical procedures. Patient demographics, clinical history, electroencephalogram (EEG) and magnetic resonance imaging (MRI) findings, and surgical interventions were recorded. Data analysis was performed using SPSS version 23.

Results: Among the 31 patients, the majority had intractable seizures, and 14 were on three or more anti-epileptic drugs preoperatively. Surgical procedures included selective amygdalohippocampectomy, temporal lobectomy, corpus callosotomy, lesionectomy, craniotomy, and hemispherectomy. Postsurgical complications were minimal. Around 32.3% of the patients achieved complete seizure freedom at 6 months, and 45.2% at 1 year.

Conclusion: Surgical procedures, including temporal lobectomy and corpus callosotomy, have shown promise in achieving seizure freedom or significant improvement in select cases. The findings emphasize the critical need for timely diagnosis and careful patient selection. Recognizing epilepsy's impact on both physical and psychosocial well-being emphasizes the importance of considering surgical options when conservative therapies prove ineffective. Increasing awareness and accessibility to specialized epilepsy centers are essential steps toward improving the management of epilepsy in developing countries.

Keywords: Amygdalohippocampectomy; Corpus callosotomy; Epilepsy; Lobectomy; Pakistan.

Abbreviations: AED: Anti-Epileptic Drug; CP: Cerebral Palsy; DNET: Dysembryoplastic Neuroepithelial Tumor; EEG: Electroencephalogram; LGS: Lennox Gastaut Syndrome; LPDs: Lateralized Periodic Discharges; MRI: Magnetic Resonance Imaging; MTLE: Mesial Temporal Lobe Epilepsy

Introduction

The incidence of epilepsy in developed countries is currently estimated to be 240 people per 100,000 inhabitants and the rate for active epilepsy in Pakistan is 9.99 per 1,000 population [1]. Considering the global incidence of epilepsy, particularly in low- and middle-income countries like Pakistan, where early onset and drug resistant cases are prevalent, the introduction of epilepsy surgeries in 1998 marked a significant milestone in improving the management of this condition. Epilepsy surgery is conventionally offered to patients who are drug-resistant, defined by the International League Against Epilepsy as those who failed to achieve sustained seizure freedom after adequate trials of two appropriately chosen and tolerated used alone or in combination [2]. Early treatment, especially for those with refractory and focal epilepsies, can result in better physical and mental health as well as strong psychosocial functioning. Seizure freedom is achieved in a variable proportion of patients according to epilepsy type, underlying pathology, and duration of follow-up, reported. Surgical procedures for epilepsy include resection (anteromedial temporal lobectomy, focal neocortical resection, lesion resection, and hemispherectomy) and disconnection procedures (corpus callosotomy and multiple subpial transections). The focus of this current study was to review the postoperative seizure outcomes of patients that underwent epilepsy surgery at our center over a 20-year period. Our primary objective was to evaluate the effectiveness of epileptic surgeries in terms of decrease in the seizure frequency and reduction in the required dosage of anti-epileptic medications.

Material & methodology

It was a retrospective observational cohort study carried over a period of 20 years in one of the largest hospitals in Pakistan from January 2002 to December 2022. All patients were admitted for epilepsy surgery during the study duration. Inclusion criteria included all patients having either focal epilepsy, focal to secondary generalized, or generalized epilepsy. While patients with multi-origin seizures and pregnancy were excluded. Approval was sought from the Ethical Research Committee, and data was collected by the primary investigator. All information was obtained from the patient's medical record as per the designed performa. All demographics, and clinical history along with video electroencephalogram (EEG) findings and magnetic resonance imaging (MRI) brain findings were recorded by an investigator on the questionnaire. Data files were reviewed, and relevant information were recorded into a Performa. SPSS version 23 was used for data analysis.

Results

In our study population of 31 patients, 21(67.7%) were male, and 10(33.3%) were female. Among these, 17 had a history of focal seizures, 10 had a history of focal seizures with subsequent secondary generalization, and 4 experienced generalized seizures (Table 1). Figure 1 further shows the seizure patterns in different genders. The mean age of onset of epilepsy in both genders 11.75 years and the mean age of surgery was 17.8 years (Table 2). Notably, 14 patients were using three or more anti-epileptic drugs, with 10 of them still on three anti-epileptic agents at the time of surgery, while 7 were on 2 anti-epileptic agents. Remarkably, only one patient had a family history of epilepsy, a female patient diagnosed with dysembryoplastic neuroepithelial tumor (DNET) who underwent surgical excision.

A significant majority of the patients, specifically 24 out of 31,

Table 1: Clinical characteristics of study population (n=31).

	n (31)	Percentage (%)
Gender		
Male	21	67.7
Female	10	33.3
Type of epilepsy		
Focal	17	54.8
Generalized	4	12.9
Focal to secondary generalization	10	32.3
No. of anti-epileptics before surgery		
1 AED	0	0
2 AED	7	22.6
3 AED	10	32.3
>3 AED	14	45.2
Family history of epilepsy	1	3.23
Etiology		
MTLE	11	35.5
Tumor	2	6.45
LGS/CP	8	25.8
Vascular	8	25.8
Unknown	2	6.45
Intractable epilepsy	24	77.4
Video EEG findings		
Not done	10	32.3
Temporal focal seizure disorder	8	25.8
Temporal to secondary generalization	6	19.4
Generalized	3	9.68
Parietocentrotemporal focal seizure	1	3.23
Fronto-central focal seizure disorder	2	6.45
Generalized + multifocal	1	3.23
Type of surgery:		
Selective amygdalohipocampectomy	10	32.3
Temporal lobectomy	9	29.0
Corpus callosotomy	8	25.8
Lesionectomy	1	3.23
Corpus callosotomy + temporal lobectomy	2	6.45
Hemispherectomy	1	3.23
Complications of surgery		
Unilateral Weakness	2	6.45
Fever	4	12.9
Memory loss (short term)	1	3.23
Mortality post-surgery	1	3.23
Outcome (6 months)		
Complete seizure free since surgery	10	32.3
Partially seizure free since surgery	13	41.9
No seizure reduction	8	25.8
Outcome (1 year)		
Complete seizure free since surgery	14	45.2
Partially seizure free since surgery	10	32.3
No seizure reduction	7	22.6

AED: Anti Epileptic Drug; CP: Cerebral Palsy; EEG: Electroencephalogram; LGS: Lennox Gastaut Syndrome; Lpds: Lateralized Periodic Discharges; MTLE: Mesial Temporal Lobe Epilepsy.

Table 2: The mean age of onset of epilepsy in both genders 11.75 years and the mean age of surgery was 17.8 years.

Mean age of onset of epilepsy	11.75 years
Mean age of surgery	17.8 years
Mean duration of seizures before surgery	6.86 years
Mean age of male patients at the time of surgery	17.09
Mean age of female patients at the time of surgery	20.4

suffered from intractable seizures, highlighting the challenging nature of their condition. Routine brief EEG findings were typically normal for most patients, while 7 exhibited signs of a temporal focal seizure disorder. Additionally, 4 patients displayed parietotemporal EEG abnormalities, and 4 had multifocal plus generalized seizure pattern. Among others, 3 patients experienced generalized seizures, while each had fronto-temporal focal seizure disorder, hemispheric slowing, and LPDs (Lateralized periodic discharges) respectively. Furthermore, 21 patients underwent video electroencephalogram (EEG) assessments, with temporal focal seizure disorder being the most prevalent finding. The most common abnormal magnetic resonance imaging (MRI) brain finding was mesial temporal lobe epilepsy (MTLE) (Figure 2). With regards to surgical intervention, most of the patients underwent selective amygdalohippocampectomy (10 out of 31), followed by 9 patients who underwent temporal lobectomy, and 8 who underwent corpus callosotomy. Additionally, 2 patients underwent corpus callosotomy and temporal lobectomy both, while hemispherectomy and lesionectomy were performed in individual cases (Figure 3). Regarding postsurgical complications, a minority of the patients experienced fever, unilateral weakness, and short-term memory loss. And one patient expired post-surgery.

Results further revealed that 32.3% of patients (10/31) achieved complete freedom from seizures at 6 months, with this number increasing to 45.2% (14/31) at 1 year follow-up. Additionally, 41.9% (13/31) patients experienced partial seizure freedom at 6 months, and 32.3% (10/31) at 1 year, Meanwhile, 25.8% (8/31) of the patients had no change in seizure frequency at 6 months, and this percentage slightly decreased to 22.6% (7/31) at 1 year follow-up.

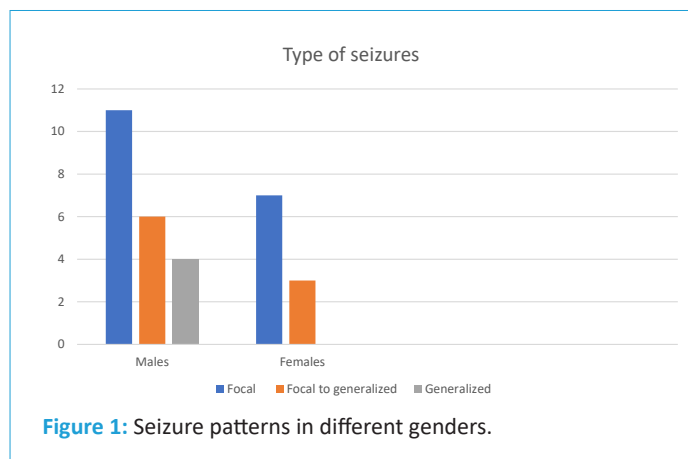


Figure 1: Seizure patterns in different genders.

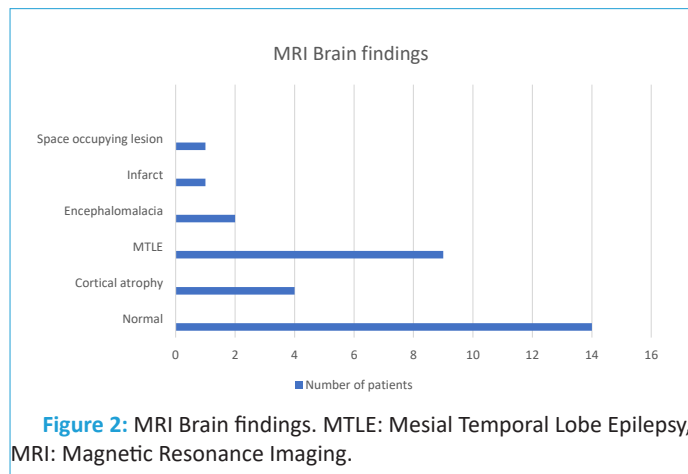


Figure 2: MRI Brain findings. MTLE: Mesial Temporal Lobe Epilepsy, MRI: Magnetic Resonance Imaging.

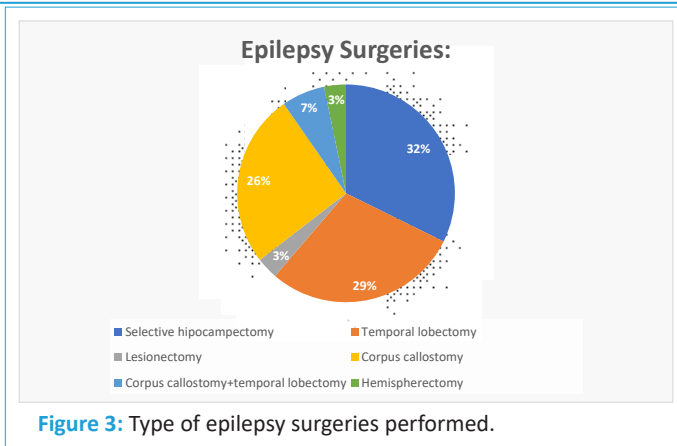


Figure 3: Type of epilepsy surgeries performed.

Discussion

The tradition of epilepsy surgeries dates to the 1800s in England when neocortical resection was initially performed experimentally [3]. Developments such as mesial temporal lobe resection have formed the basis of modern epilepsy surgeries. Yet, much of the world, including Pakistan, remains unaware of its advantages, leading to its underutilization. A major contribution to this reality is the scarcity of specialized epilepsy centers and trained surgical teams, coupled with the high cost of the surgeries, making these procedures inaccessible to a large portion of the population, particularly in developing countries. Additionally, societal stigmas associated with epilepsy can deter individuals from seeking interventions, further perpetuating the underutilization of this effective treatment option.

The findings of this retrospective study on epilepsy surgeries in Pakistan provide valuable insights into the clinical profile and outcomes of patients undergoing surgical intervention for epilepsy. Notably, epilepsy is a significant neurological disorder with varying prevalence. In a study by Aziz et al., the mean onset of epilepsy was 13.3 years, and 74.3% of epileptic persons were aged <19 years at the onset of the disorder [4]. The results are somewhat like our study and these statistics highlight the early onset of epilepsy in a significant segment of the population and emphasize the importance of timely intervention and management strategies.

Comparing our findings with previous studies conducted in different regions, it becomes evident that epilepsy surgery outcomes can vary significantly based on patient demographics, seizure types, and the surgical procedure performed. For instance, a 24-year experience summary from the University of Washington Medical Centre revealed that most patients who underwent surgery experienced complex partial seizures, with most undergoing temporal lobe resections. In this cohort, a substantial 76 percent of patients became seizure-free, while in our study, around 45.2% patients were seizure free at 1 year follow-up [5]. These findings resonate with our study outcomes in which 74 % of patients showed improvement, either in the form of complete freedom from seizures or partial reduction in seizures at 6 months. And 77.4 percent of the patients showed improvement in seizures at 1 year.

Additionally, another investigation was carried out across two prominent teaching hospitals, focusing on individuals with treatment-resistant epilepsy. The findings revealed that the average age of the patients was 38.3 years, with an average duration of epilepsy diagnosis spanning 17.3 years. Notably, a significant 88.0 percent of these patients were primarily diagnosed with focal epilepsy. Among this group, 11 patients,

comprising 22.0 percent, underwent neurosurgical procedures as part of their treatment regimen [6]. Moreover, longitudinal studies have confirmed that an earlier age at surgery and a shorter duration of epilepsy are associated with better neuropsychiatric and psychosocial outcomes [7]. Like our study, these studies collectively highlight the importance of early diagnosis, careful patient selection, and the appropriate choice of surgical procedure to achieve the best possible outcomes for individuals suffering from drug-resistant epilepsy.

Considering the possible association between epilepsy and behavioral issues, it is important to consider when to perform epilepsy surgery. People with uncontrollable seizures not only have seizures themselves, but they also live in constant fear of having more seizures. Even if there's no specific intellectual deficit, a child with consistently abnormal brain activity can struggle academically due to limited study time and their social interactions at school and at home can be affected, often leading to behavioral problems and dependence. For these reasons, it is important to explore surgical options somewhat if aggressive therapy has proven ineffective.

Conclusion

To conclude, our study highlights the important need for early intervention in patients with drug resistant epilepsy. While the findings align with international studies, demonstrating the efficacy of surgical procedures in select cases, they also highlight the significance of early timely diagnosis and patient selection. Recognizing the impact of epilepsy on both physical and psychosocial well-being emphasizes the importance of exploring surgical options when conservative therapies prove ineffective.

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