Research Article

Open Access Journal of
Biomedical Science
ISSN: 2690-487X

Epidemiological Characteristics of Epileptic Surgery

Carolina Sofia Perez Lora[1]*, Dionny Marcela Padilla Ruiz[2], Jean Carlos Esquivel Monterroza[3], Anyela Lucía Anaya Novoa[4], María Claudia Pérez Martínez[4], Jassay Hazarel Solano Cerchiaro[5], Ana María Andrea Mejía[6], Jessica Marcela Mahuad Suárez[7] and Ariel Ramón Díaz Ruiz[8]

[1]General doctor, University of the North, Colombia, https://orcid.org/0009-0008-6938-4539

[2]Clinical Neurology Resident of the Medical Sciences University from Havana, Cuba, https://orcid.org/0000-0003-3358-0390

[3]General doctor, Universidad de Sucre, Colombia, https://orcid.org/0000-0001-7383-715X

[4]General doctor, Universidad del Sinú, Colombia, https://orcid.org/0000-0002-5180-6915; https://orcid.org/0000-0001-8617-4762

[5]General doctor, Fundación Universitaria Juan N Corpas, Colombia, https://orcid.org/0000-0001-9075-3644

[6]General doctor, Universidad Cooperativa de Colombia, Colombia, https://orcid.org/0000-0002-3126-0636

[7]General doctor, Universidad del Sinú, Colombia, https://orcid.org/0000-0003-0539-2886

[8]General doctor of the University of Sinú, Colombia, https://orcid.org/00000003-3753-333X

ABSTRACT

Background: It is considered that approximately 30% of patients with epilepsy of any type will persist with epileptic seizures despite drug therapy.

Aim: Know the epidemiological characteristics of epileptic surgery.

Methods: A detailed bibliographic search of the most relevant published information is carried out in the pubmed, scielo, medline, national and international library databases.

Results: Epileptic surgery offers the possibility of eliminating seizures by 40-50% in patients with epilepsy refractory to antiepileptic drugs. Surgery includes curative and palliative resection procedures, for which pre-surgical evaluation by an interdisciplinary team is essential. However, it is underused especially in developing countries.

Conclusion: Countries belonging to the European continent were the pillar for the development of the different surgical techniques that we know today. However, countries like Indonesia and India in recent years have also positioned themselves in the management of epilepsy through surgery. But other Asian countries, Latin American countries, even North American countries, their application is scarce due to the scarce resources they have and the low rate of referrals.

KEYWORDS: Epidemiology; surgical intervention; epilepsy

INTRODUCTION

According to the World Health Organization, epilepsy is a non-communicable chronic brain disease that affects around 50 million people worldwide, representing 0.8% of the global prevalence. This pathology is generally characterized by the presence of recurrent seizures, which are defined as those short episodes of involuntary movement that can appear partially when it involves a part of the body or generalized when it involves the whole body

Quick Response Code:

Address for correspondence: Carolina Sofia Perez Lora, General practitioner, University of the North, Colombia, https://orcid.org/0009-0008-6938-4539

Received: March 02, 2023 **Published:** July 10, 2023

How to cite this article: Carolina SPL, Dionny MPR, Jean CEM, Anyela LAN, María CPM, et al. Epidemiological Characteristics of Epileptic Surgery. 2023- 5(4) OAJBS.ID.000560. **DOI:** 10.38125/OAJBS.000560

and are sometimes accompanied by loss of consciousness. and control of intestinal or bladder function [1]. In turn, its incidence varies depending on the different latitudes, being more frequent in developing countries than in industrialized countries [2]; (Table 1).

Table 1: Types of surgery as treatment of epilepsy after medication failure.

Surgical Procedure	Indications	Considerations
Anteromedial Temporal Resection (AMRT)	Complex partial seizures with typical symptoms of epilepsy of the mesial temporal lobe.	It is the most commonly performed operation for medial temporal lobe epilepsy disorder. Serves as a model for focal resections
	MRI evidence of unilateral hippocampal atrophy and increased T2-weighted signal.	
	Unilateral temporal lobe hypometabolism on positron emission tomography.	
	EEG confirmation that the seizures begin in the temporal area ipsilateral to the hippocampal atrophy or evidence of hypermetabolism.	
Corpus Callosotomy	Other than the requirement that the patient must experience medically refractory seizures, the indications for callosotomy of the body have not been clearly defined. Also, unlike AMTR for complex partial seizures, there are no clear and consistent indicators to help identify patients likely to benefit from corpus callosotomy.	This is the only surgical procedure applicable to generalized epilepsy syndromes
Functional Hemispherectomy	Candidates are people who have lesions and seizures limited to 1 hemisphere of the brain. His seizures occur frequently enough to interfere with cognition and affect quality of life.	Hemispherotomy
Multiple Subpial Transaction	The most effective surgical treatment of partial (focal) seizures has been removal of the cerebral cortex that produces the seizures.	It has limited applications and is less used in recent years

The treatment of patients with epilepsy includes different options. In developing countries, management with antiepileptic drugs is the most widely used. However, some patients are not free of seizures, so surgical treatment is the method that offers very satisfactory results to this group of patients. Applying to this type of surgery requires careful selection. It must be taken into account that carrying out the procedure requires high-tech resources and, therefore, is very expensive. Among the satisfactory results, it has been shown that surgery today offers high possibilities of making crises disappear (from 30-40% to 90%, depending on the type of epilepsy) with minimal percentages (less than 1%) of causing serious superimposed lesions and has a success rate that varies according to different authors, between 90 and 95% [3]. For all of the above, the goal of surgery to treat epilepsy is to stop seizures or limit their severity with or without the administration of medication. This is done through a procedure that removes an area of the brain where seizures occur. It is evident that it is more effective when the seizures always occur in a single place in the brain [4]. Likewise, it is well described that epilepsy arises from the abnormal activity of certain brain neurons, therefore, the type of surgery depends on the location of the neurons that initiate the seizure and the age of the patient.

Regarding the epidemiology of surgical techniques, the most frequent type of intervention to treat epilepsy is resistive surgery, consisting of the extraction of a small part of the brain, that which is affected, generally the temporal lobes. Approximately 20-30% of people with epilepsy are drug resistant, and of these, 10-50% may be eligible for surgery, Based on this estimate and overall prevalence, the number of potential candidates for epilepsy surgery worldwide the world ranges from 1 million to 7.5 million people [5,6]. In patients suffering from multifocal or generalized epilepsy, the resection of an epileptic focus is not favorable. For this reason, other types of surgical interventions have been considered, called palliative because they do not guarantee more than a 10% chance of eradicating the crises, although they produce an improvement in their frequency and intensity in 50% of patients. among which is the Section of the Corpus Callosum and the Stimulation of the Vagus Nerve. In addition, functional hemispherectomy has ceased to be used today, associated with serious long-term complications, specifically superficial hemosiderosis, and has been replaced by hemispherotomy.

MATERIALS AND METHODS

A detailed bibliographic search of the most relevant published information was carried out in the databases pubmed, scielo, medline, national and international libraries specialized in the topics covered in this review article. The following descriptors were used: Epidemiology, Surgical intervention, Epilepsy. The data obtained oscillate between 15 and 30 records after the use of the different keywords. The search for articles was conducted in Spanish and English, limited by year of publication, and studies published from 2003 to the present were used.

RESULTS

Results of all the articles selected for this study are presented; followed by the analysis of the main epidemiological characteristics of epileptic surgery. Based on the results of the articles found, which meet the inclusion criteria in this study, it is recommended that patients with drug-resistant epilepsy be evaluated in epilepsy surgical institutions, especially those with brain lesions. The most recommended surgical techniques are craniotomy with lobectomy, lesionectomy, anatomical or functional hemispherectomy, and more adapted resections with invasive monitoring techniques due to their potential curative effects [7,8].

Initially, epilepsy surgery was based on the identification of visible cortical lesions, generally of traumatic origin. The era of

modern epilepsy surgery began with the first operation performed in 1886 by Sir Victor Horsley and William Macewen, becoming pioneers in the area, in which other neurosurgeons such as Fedor Krause and Otfrid Foerster stood out. The founding countries in which epilepsy surgery was performed in Europe were the United Kingdom, Germany, and the Netherlands [9]. Therefore, years later Baud et al. carried out a study where they evaluated 2 cohorts of children and adults in 16 hospitals who underwent epilepsy surgery in the period from 1997 to 1998 (n=562) and from 2012 to 2013 (n=736), to measure European trends in epilepsy surgery and found modest but significant improvements in European epilepsy surgery over time, including increased surgical volume, shorter disease duration, and better surgical outcomes. post-surgical seizures. Over time, the number of operated cases per center increased from a median of 31 to 50 per 2-year period (p=0.02). The mean duration of the disease at the time of surgery decreased by 5.2 years (p< 0.001) [10]. Although epilepsy surgical procedures are underutilized worldwide, epilepsy surgery appears to be established in some of these centers in Asia and Latin America, while some are in their embryonic stage, yet postoperative seizure-free rates and quality of life are comparable to those in high-income countries [11]. For example, in countries such as Indonesia, epilepsy surgery began in July 1999 under the direction of universities in Japan, since that date 589 patients have been registered who were treated until December 2017, where intracranial electrode monitoring has been implemented in the sum of 62 surgeries [12]. Even countries like India have experienced favorable changes in this type of surgical techniques. Currently, 39 centers are performing epilepsy surgeries in India on a regular basis. Of these, 18 centers have come into operation in the last five years. Many of them are well equipped with state-of-the-art technologies and are experienced in performing all types of epilepsy surgeries. As of July 31, 2016, approximately 7,143 epilepsy surgeries have been performed in India. Currently, 734 epilepsy surgeries are performed in India each year, representing an increase of approximately 58% in the past three and a half years compared to previous years. Postoperative outcomes reported from all of these centers are comparable to those reported from well-established centers in high-income countries [13]. Although epilepsy surgery in resource-poor countries was first performed in the 1950s, 80% of developing countries still do not have an epilepsy surgery center [14]. This is reflected in studies where their results report that 3 countries (Brunei, Cambodia and East Timor) do not have epilepsy centers, and 2 countries (Laos, Myanmar) have level 2 centers that only perform tumor surgery. Level 3 epilepsy centers are available in 6 countries (Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam); only 5 countries (Indonesia, Malaysia, Philippines, Singapore, Thailand) have at least one level 4 epilepsy care center. Indonesia, with 261 million inhabitants, has only one level 3 and one level 4 center [15]. At the Latin American level, surgical centers or services for people with epilepsy show that there are 94 surgical centers, distributed in 16 countries (64.0%). There are nine countries (36.0%) without this resource. The South American subregion has the largest amount, with a total of 76 centers or services. The total number of people per year who underwent epilepsy surgery is higher in the South American subregion with 258 cases; Mexico, Central America, and the Latin Caribbean had only 35 cases of surgery, and the English-speaking Caribbean reported no cases of surgery for epilepsy [16]. This indicates that epilepsy surgery continues to be underused. Additionally, a recent report from the Ontario Health Technology Advisory Committee estimated that 2% of Ontario patients eligible for such surgery actually received it. Despite the benefits obtained by patients as evidenced in drug-resistant focal epilepsy, where resistive brain surgery results in seizure freedom in approximately 57% of patients undergoing neocortical resections and 70% of those undergoing temporal anteromesial resections, compared to 5-8% of patients receive optimal medical treatment. A meta-analysis of randomized controlled trials and 19 observational studies comparing surgery with medical treatment found an absolute risk reduction of 42% (95% CI 32%–51%) for any seizure recurrence in patients who underwent surgery [17]. However, it is suggested that epilepsy surgery is less effective when there are extratemporal lesions and when the epilepsy is not associated with a structural lesion or both, the results of which are similar between children and adults. Importantly, two randomized clinical trials involving 118 patients with temporal lobe epilepsy found greater seizure freedom with surgery compared with continued medical therapy (58% vs. 8% [n=80] and 73%). % vs 0% [n = 38], P < .001). Likewise, nine systematic reviews and 2 large case series of medically refractory patients treated with surgery reported seizure-free outcomes in 34% to 74% of patients (median, 62.4%) .001). Likewise, Nine systematic reviews and 2 large case series of medically refractory patients treated with surgery reported seizure-free outcomes in 34% to 74% of patients (median, 62.4%); .001). Likewise, nine systematic reviews and 2 large case series of medically refractory patients treated with surgery reported seizure-free outcomes in 34% to 74% of patients (median, 62.4%); [18].

DISCUSSION

Epileptic surgery was described and implemented some years ago. In developing countries, antiepileptic drugs are the mainstay of treatment. However, in ⅓ of patients, pharmacological treatment does not eliminate the seizure episodes. Epilepsy surgery is underused in developed countries, and especially in developing countries, either because of a lack of resources or because many clinicians do not recognize that a treatable syndrome exists despite the significant decrease in episodes. Candidates for this surgery are those who have not achieved acceptable seizure control, patients with disabling complex partial seizures, with or without secondary generalized seizures, who have failed appropriate trials of first-line AEDs and who have been referred to an epilepsy center and meet established criteria for anteromedial temporal resection and who accept the risks and benefits of the procedure, taking into account morbidity and mortality including uncontrolled seizures such as accidental injuries, cognitive impairment, sudden unexplained death in epilepsy, and psychological, social, and vocational impairment [19]. Careful selection of candidates will lead to a better chance of being seizure-free, thus requiring multiple modalities of pre-surgical investigations, such as video-EEG, intracranial EEG, high-resolution imaging, advanced functional imaging, and clinical analysis. A multidisciplinary approach is essential, including close collaboration between neurosurgeons, neurologists, neurophysiologists, neuropsychologists, neuropsychiatrists and neuroradiologists. Epilepsy surgery includes a variety of surgical procedures, including resection surgery for refractory focal seizures, which offers a significant chance of seizure freedom in extratemporal and temporal lobe epilepsy. Palliative treatment for patients who are not candidates for resection surgery, such as vagal nerve stimulation, deep stimulation, and callosotomy, offer other options [20]. Although a multicentre randomized trial has not been performed, published data from individual centers and pooled data from the University of California Los Angeles Palm Desert Conference show that seizure surgery results in a seizure-free outcome in the majority of patients with hippocampal sclerosis or lesion well delimited [21]. Therefore, there are a variety of classification systems that include the Engel,

International League Against Epilepsy (ILAE) and the classification of cognitive development, behavioral and psychosocial outcome and improvement in health-related quality of life (HRQOL) for the evaluation of the results of this surgery [22-24].

Other authors support the efficacy of epileptic surgery when it is refractory to drugs, which is evidenced in the absence of seizures at least one year after surgery, observed in 53-84% of patients with medial temporal lobe epilepsy in 36-76% of patients with epilepsy outside the medial temporal lobe and in 43-79% of patients after hemispherectomy [25,26]. Even the results of the Danish epilepsy surgery program for the period 2009-2014 agree with the international results. However, 10% of patients report that they do not benefit from surgical treatment [27]. Based on the results of several recent pediatric surgical series, The chance of a favorable seizure outcome after surgery is not negatively affected by a younger age, with a seizure-free postoperative outcome reported for 60-65% of infants. 59-67% of children and 69% of adolescents, compared with 64% reported in a large series of predominantly adults. Some subgroups of patients may be more likely than others to have a seizure-free outcome after epilepsy surgery. Outcomes are better, with more patients achieving seizure freedom after temporal resection (78%) than after extratemporal or multilobar resection (54%), with intermediate results after hemispherotomy (69%). Seizure-free outcome is higher when the aetiology is tumor (82%) than when it is cortical dysplasia (52%), and this difference persists whether the resection was temporary or extratemporal/multilobar.

In children with intractable temporal lobe epilepsy caused by hippocampal sclerosis, 78% seizure freedom was achieved, and these results were similar to those in adults. The presence of a focal lesion on MRI is the most important predictor of a favorable outcome in all series [28]. Despite the fact that surgical treatment is safe and effective, demonstrated in three randomized controlled trials, less than 1% of patients are referred for surgery. Recent series do not indicate an increase in surgical referral in the last two decades. One study suggests that the decline in referrals to major epilepsy centers may be explained by the increase in referrals to low-volume non-teaching hospitals where outcomes are poorer and complication rates higher [29]. Therefore, it is recommended to inform the health personnel of the institutions where the interdisciplinary team and the resources are available to improve the quality of life of patients with this condition. A study evaluating a total of 1,110 patients (1,006 treated surgically and 104 non-surgically) for a total follow-up of 8,126.62 person-years from 1986 to 2013, observed that brain surgery is associated with a reduction in the rate of mortality in drug resistant epilepsy, both when seizures are abolished and when it results in significant palliation of tonic-clonic seizure frequency. Patients treated surgically had a lower mortality rate (8.6 per 1000 person-years [95% confidence interval (CI) 6.58-11.15]) than patients treated without surgery (25.3 per 1000 person-years [14.50-41.17], $p < 0.001$); [30].

Like any other surgical procedure, there may be complications or unwanted results. The neurological complications of epilepsy surgery actually depend on the extent and location of surgical resection and pre-existing functional deficits and are governed by hemispheric language proficiency, vascular injury, and proximity to critical white matter tracts. and the eloquent bark. Reported complication rates were highest in patients older than 50 years and ranged from 6 to 25%. The most common complication was a permanent visual field deficit, sufficient to prevent driving, in 9.4% after temporal lobe resection [31]. The prediction of postoperative results is associated with recent series, the risks of serious surgical complications have decreased dramatically over the years to fall below 1% in temporal lobe resections, and some data suggest that control of long-term seizures could be achieved in more than 80% of patients with mesial temporal lobe epilepsy or neocortical epilepsy associated with focal cortical dysplasia type 2.

CONCLUSION

Countries belonging to the European continent were the pillar for the development of the different surgical techniques that we know today. However, countries like Indonesia and India in recent years have also positioned themselves in the management of epilepsy through surgery. But other Asian countries, Latin American countries, even North American countries, their application is scarce due to the scarce resources they have and the low rate of referrals.

REFERENCES

1. Organizacion Mundial de la salud, epilepsia datos y cifras (2022) disponible en: Epilepsy.
2. Sánchez LP (2020) Epilepsia: algunas denominaciones dadas a través de los siglos. Medicina 42 (3): 486-490.
3. Guerrero-Pérez R, et al. (2014) Tiempo estimado entre inicio de crisis y tratamiento quirúrgico en pacientes con epilepsia refractaria. Arch Neurocien19(3): 153-156.
4. Mejía-T, Marco A, et al. (2014) Cirugía de epilepsia en el Hospital Nacional Guillermo Almenara: primeros siete casos. Acta méd. peruana 31(4): 199-212.
5. Manuel CP, Otayza MF (2013) Consideraciones quirúrgicas propias de la epilepsia en niños. Revista Médica Clínica Las Condes 24(6): 1019-1026.
6. Nicholas KS, Guadalupe Fernandez BV (2018) Epidemiologist's view: Addressing the epilepsy surgery treatment gap with minimally-invasive techniques. Epilepsy res 142: 179-181.
7. Jorge Guridi , Aparicio JA, Barcia JA, Garcia de Sola R, Garcia Salazar F, et al. (2009) Guías clínicas para la cirugía de la epilepsia y de los trastornos del movimiento. Neurosurgery 20(4): 1130-1473.
8. Elaine SS, Rohini C (2021) Epilepsy surgery: Monitoring and novel surgical techniques. Neurol Clin 39(3): 723-742.
9. Schijns OE, Hoogland G, Kubben PL, Koehler PJ (2015) The start and development of epilepsy surgery in Europe: a historical review. Neurosurg Rev 38(3): 447-461.
10. Maxime OB, Thomas P, Attila R, Max CP, Christian E, et al. (2018) European trends in epilepsy surgery. Neurology 91(2): e96-e106.
11. Musa MW, Fenglai X, Mark RK, Anna M, Andrea SW, et al. (2019) Epilepsy surgery in low-and middle-income countries: a scoping review. Epilepsy Behav 92: 311-326.
12. Arifin MT, Ryosuke H, Yuriz B, Aris CB, Koji I, et al. (2021) Initiating an epilepsy surgery program with limited resources in Indonesia. Sci Rep 11(1): 5066.
13. Chaturbhuj R, Radhakrishnan K (2017) Epidemiology of epilepsy surgery in India. Neurology India 65: S52-S59.
14. Qiu J (2009) Epilepsy surgery: challenges for developing countries. The Lancet Neurology 8(5): 420-421.
15. Musa MW, Fenglai X, Mark RK, Anna M, Andrea SW, et al. (2019) Epilepsy surgery in low-and middle-income countries: a scoping review. Epilepsy Behav 92: 311-326.
16. Kevin PB, Alba NF, Alejandra CR, Paulo S de M, Elif UK, et al. (2022) Burden of epilepsy in Latin America and The Caribbean: a trend analysis of the Global Burden of Disease Study 1990-2019. The Lancet Regional Health-Americas 8: 100140.

17. Jette N, Reid AY, Wiebe S (2014) Surgical management of epilepsy. CMAJ 186(13): 997-1004.

18. Barbara C Jobst, Gregory D Cascino (2015) Resective epilepsy surgery for drug-resistant focal epilepsy: a review. CMAJ 313(3): 285-293.

19. Erica MBB, David GV (2019) Adult epilepsy. Physician's Field Guide to Neuropsychology. Springer, New York, USA pp. 379-398.

20. Tamimi Ah, Malik J, Iskandar T (2022) Recent advances in epilepsy surgery. Intechopen. 10(5772): 107856

21. Passaro E, Jobe K (2018) Outcome of epilepsy surgery editor. Medscape.

22. Wieser HG, Blume WT, Fish D, Goldensohn E, Hufnagel A, King D, et al. (2008) ILAE commission report. proposal for a new classification of outcome with respect to epileptic seizures following epilepsy surgery. Epilepsia. 42(2): 282-286.

23. Engel JVNP, Rasmussen TB, Ojemann LM (1993) Outcome with respect to epileptic seizures. with respect to epileptic seizures. Health, Raven Press, New York. USA 2(7).

24. Engel Jerome (1993) Outcomes with respect to quality of life. In: Engel J Jr, (edn). Surgical Treatment of the Epilepsies. 2nd edn, Raven Press Ltd, New York, USA 43(8).

25. Pinborg LH, Jespersen B, Beniczky S, Fabricius M, Rasonyi G, et al. (2018) Epilepsy surgery. Ugeskr Laeger 180(13): V09170653.

26. Spencer S, Huh L (2008) Outcomes of epilepsy surgery in adults and children. Lancet Neurol 7(6): 525-537.

27. Holm E, Foged MT, Beniczky S, Jespersen B, Brennum J, et al. (2018) Efficacy of the Danish epilepsy surgery programme. Acta Neurol Scand 137(2): 245-251.

28. Jayalakshmi S, Vooturi S, Gupta S, Panigrahi M (2017) Epilepsy surgery in children. Neurol India 65(3): 485-492.

29. Engel J Jr (2018) The current place of epilepsy surgery. Curr Opin Neurol 31(2): 192-197.

30. Sperling MR, Suzanne B (2016) A reappraisal of mortality after epilepsy surgery. Neurology 86(21): 1938-1944.

31. Vejay N Vakharia, John SD (2018) Getting the best outcomes from epilepsy surgery. Annals of neurology 83(4): 676-690.

32. Philippe R, Sylvain R (2016) Predicting epilepsy surgery outcome. Current opinion in neurology 29(2): 182-188.