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Review Article

Epilepsy surgery in Nigeria: the current state and prospects

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ABSTRACT

Epilepsy, a common neurologic disease, has puzzled mankind since ancient times. The disease has been attributed to different scientific, metaphysical, and spiritual causes and as such many interesting treatment modalities have been used in its management. The course of the modern-day management of epilepsy mirrors the advances in understanding of medicine and neuroscience over time, as well as technological advancements of the past century. Although anti-epileptic drugs (AEDs) are widely used as the mainstay of treatment, some forms of epilepsy are pharmaco-resistant. To tackle these pharmaco-resistant or anatomically complex forms of epilepsy, many neuroscientists, neurologists and neurosurgeons have researched, developed, and refined several successful surgical approaches for the treatment of epilepsy over the past century. These surgeries have revolutionized care for patients with drug resistant epilepsy ensuring seizure control or complete seizure freedom and are widely used in developed countries. Unfortunately, access to epilepsy surgery (ES) is little or non-existent in countries of the global south, often due to varying combinations of financial and infrastructural constraints as well as knowledge and skill gaps among healthcare professionals, and cultural and religious beliefs among the populace. In Nigeria particularly, ES is in the nascent stage and efforts to improve access to ES through local research and international collaborations for capacity building and system strengthening are currently underway.

Keywords: Epilepsy surgery, Anti-epileptic drugs, Nigeria

INTRODUCTION

Epilepsy is the most common neurological disorder, affecting an estimated population of about 70 million people worldwide. Over 56 million of these people live in developing countries, with more than 75% with no access to treatment.[1,2]

Global statistics show that about one-third of patients with epilepsy are refractory to AEDs even with good compliance and dosing.[3] ES has been found to be effective in refractory epilepsy, with 58% of patient with refractory temporal seizures becoming seizure free.[4]

Although ES has been in existence for decades, over 80% of developing countries do not have an ES program.[5] A recent cross-sectional study by Kissane et al to evaluate the state of ES in Africa showed that only 8 of out of the 51 African nations have access to ES with procedures mostly restricted to 2-12 cases per month.[6] This inaccessibility to ES in Africa implied that people with refractory epilepsy in developing countries cannot benefit from these procedures, leading to poor seizure control, socio-economic impact and reduced quality of life.

With Nigeria's estimated population of 217 million, a meta-analysis on the burden of epilepsy in Nigeria put the overall prevalence rate at 8 per 1000 people.[7,8] A large percentage of this population has no access to treatment options, with AEDs not readily available in some regions. Despite advances in ES programs in developed countries, Nigeria currently has no ES program.

This paper discussed ES from a historical perspective, highlighted the current realities and challenges facing epilepsy care in Nigeria, and also examined what the future held for ES in Nigeria.

ES: history and impact

The history of epilepsy and its treatments date back to antiquity. Several causes, physical and metaphysical and treatments have been postulated over the centuries.[9] The earliest surgery for epilepsy was skull trephination which was presumed to release harmful/epileptogenic agents from the brain.[9,10] With advances in neuroscience, the understanding and treatment of epilepsy have greatly improved. In particular, seizure localization and surgical treatment have evolved over the past 150 years due to the advent of modern-day technology.[11] Consequently, there are more treatment options with improved outcomes for patients with anatomically complex and/or pharmaco-resistant epilepsy.[10,12]

Building on existing clinical and physiological data, in 1867, John Hughlings Jackson confirmed the physical basis for epilepsy by characterizing the Jacksonian march-somatotopic movement of a seizure through the motor cortex and suggested therapeutic resection of the affected cortical focus.[9,11,12] In 1886, Horsley presented a case series of 3 patients in which he had successfully performed craniotomies with resection of epileptogenic foci inspired by Jackson's work.[11,12] While Horsley's work could mainly be applied to lesional causes of epilepsy (post-traumatic lesions, tumors), Krause refined his methods to include management of non-macroscopic causes of epilepsy. In patients with no identified macroscopic focus, Krause applied faradic stimulations along the precentral gyrus to induce seizure and identify the epileptogenic region for resection. Additionally, this resulted in the mapping of the motor cortex.[11,12] Using similar methods, Cushing characterized the postcentral gyrus as the sensory cortex.[11,12]

The 1930s saw integration of electroencephalography (EEG) and electrocorticography (ECoG) into diagnosis of epilepsy.[11] At the Montreal Neurological Institute (MNI), Penfield and Jasper used EEG and ECoG to characterize seizure activity in the mesial temporal lobe. There was however poor understanding of the functions of these mesial structures and the consequences of resection were unknown. Thus, the 1940s saw extensive research into the functions of the hippocampus and amygdala and led to more confident surgical exploration of the region.[11,12] In 1949, Jasper reported a series of 24 cases from MNI who underwent surgery due to diagnostic EEG findings with only 2 having uncal resections because there were no discrete lesions in other patients, thus proving the existence of non-lesional epileptic foci. In 1950, 68 cases were reported from MNI of which 10 had uncal resection only and 2 had additional hippocampal resection (anterolateral temporal corticectomies). However, only about 50% of these patients achieved seizure control.[11,12]

Further histopathologic and electrophysiologic studies led to redefined surgical goals and refined surgical techniques. This ultimately resulted in standardization of the anteromesial temporal lobe resection by Penfield and Baldwin which would become widely adapted in many neurosurgical centres.[11,12] By 1978, MNI had managed 1102 patients with cortical resection and 70% of patients who were adequately followed-up for at least 2 years were either completely seizure free or almost seizure free.[10]

Other surgical techniques developed include *en bloc* resection by Falconer 1953 and selective amygdalohippocampectomy (SelAH) by Niemeyer et al in the 1960s, preserving some of the anterior temporal neocortex.[11] Although stereotactic surgery had been in development for a few decades prior, it gained popularity in epilepsy surgery in the 1960s for its diagnostic and surgical precision.[11,12] Improvements in stereotactic apparatus and techniques in the 1980s and neuroimaging in the 1990s have led to the widespread use of stereotactic EEGs and ablative procedures in epilepsy surgery.[11]

Some key non-ablative/palliative surgeries have also been described in the treatment of non-focal epilepsy. Hemispherectomy was briefly used for management of brain malignancies in the 1920s and was described for epilepsy treatment in 1938.[11] The procedure has since undergone many refinements and is now used as a disconnection procedure in the management of mono-hemispheric multifocal seizures.[11] Corpus callosotomy was first introduced by Wagenen and Herren in 1940.[10,11,13] Following extensive split-brain studies and corpus callosotomy studies, the surgical technique was revised to limit complications like disconnection syndrome.[13] It has since been successfully applied in the treatment of intractable epilepsy and therefore gained popularity for this purpose in the 1970s.[11] In the last few decades, newer techniques such as radiosurgery, laser surgery, stereotaxy and endoscopy are being studied to improve the effectiveness and outcomes of callosotomies.[13]

The current state of ES in Nigeria

A vast majority of people living with epilepsy in Nigeria do not have access to care. Previous studies in Nigeria have reported a treatment gap of more than 75%.[14,15] There are various contributing factors to this vast treatment gap; these include unavailability and unaffordability of AEDs, stigmatization, poor health infrastructure and cultural beliefs.[14-16] AEDs are not widely distributed, especially in rural communities and these drugs are expensive to some patients despite their low cost, thereby contributing to non-drug compliance.[15,17] Medical management of epilepsy in Nigeria is still faced with numerous crises, and establishing an ES program is a dream far away.

ES is not readily available in developing countries, so there is a wide gap in accessing epilepsy surgery in developing countries.[5,6] Despite the obvious necessity and cost-effectiveness of surgical intervention in epilepsy, no ES facilities are currently being implemented.[6] Advanced diagnostic imaging tools such as EEG, MRI, SPECT and CT scan are all limited in their distribution.[17]

The healthcare system is grossly underfunded, making basic infrastructure, essential services and care unavailable in most hospitals. With Nigeria's currency, naira being exchanged at the rate of $1 to ₦428.38 at the time of study, the Nigerian Ministry of Health budget allocation for 2022 is 714.58 billion Naira ($166.81 billion), which is less than 5% of the total budget. Over 70% of this was allotted to recurrent expenditure, with little left for service development.[18] Establishing an ES program is not seen as a priority at the political level as the healthcare system is battling to control the rise in non-communicable diseases in addition to the numerous infectious disease outbreaks that still plague the nation.

There is a severe shortage of neurosurgeons and neurologists in the country. Nigeria has about 80 neurologists, which translates to 1 neurologist to 2.7 million people, and 77 neurosurgeons with 1 neurosurgeon for about 2.8 million people.[19,20] These trained specialists are not only in short supply, but they are also unevenly distributed, with the majority concentrated in urban areas. This shortage has resulted in a scarcity of training programs for future experts. Presently, only two centres in Nigeria provide postgraduate training in epileptology.[17]

Despite overwhelming evidence on the safety and effectiveness of ES in treatment-resistant epilepsy, most specialties are reluctant to discuss the option of ES because of bias, concerns about safety of the procedures, and varying viewpoints.[21] Most primary care doctors are unaware of surgical intervention options as AEDs are still regarded as the only treatment modality making the option of ES rarely discussed with patients.[5] Additionally, the quality of therapy provided has been harmed by the limited training in epilepsy management, which is evident in the frequent overdiagnosis and underdosage of AEDs.[5,17] There is an urgent need to strengthen and improve the quality of medical education in the country.

Cultural beliefs and stigma play a major role in the management of epilepsy in Nigeria. People living with epilepsy are highly stigmatized, and this prevents them from seeking medical care. Adewumi et al conducted a community study in Lagos, Nigeria, and discovered that residents had a poor perception and knowledge of epilepsy, with 63.4% attributing supernatural factors as a cause and the majority preferring spiritual and herbalists to orthodox medicine.[16] Fear is also perceived as a barrier to recommending brain surgery as a treatment option for epilepsy, making ES less popular in the region.[6]

Future direction

ES in Nigeria has been hampered by a variety of hindrances and obstacles; however, efforts to increase the availability of these services should not be overlooked. Support from the international community has given new life to the possibility of this specialized surgery.

The Nigerian members of the International League Against Epilepsy (ILAE) created the Nigerian League Against Epilepsy (NLAE) in 2007 to advocate for epilepsy patients' access to treatment, publication of local data and training opportunities in epilepsy care.[17] The World Federation of Neurological Sciences (WFNS) and the British National Health Service also provided grants for research aimed at improving health in resource-limited settings.[22] The WFNS was also instrumental in donating neurological equipment to Africa to advance neurological surgery on the continent.[22]

To address the critical shortage of epilepsy specialists, increased access to high-quality education, ongoing training, and workshop sessions in epileptology and recent advances in epilepsy management are required. International organizations are working to train medical personnel in low-resource settings by disseminating information and collaborating with experts in high-income countries.[17,22]

Neurosurgical training is being provided in low-middle income countries (LMIC) by the Foundation for International Education in Neurological Surgery, CURE International, and the International Federation for Spina Bifida and Hydrocephalus, with Nigerian neurosurgeons also benefiting.[22]

Sequel to WHO's recommendation shifting epilepsy care to community health extension workers, the Vanderbilt Institute for Global Health in partnership with Aminu Kano Teaching Hospital (AKTH) in Kano, Nigeria is conducting a randomized clinical trial in Kano through bridging the childhood epilepsy treatment gap in Africa (BRIDGE).[23] The findings from this clinical trial will provide evidence and sustainable model for task-shifting in childhood epilepsy treatment.[24] This has the potential to increase access to care and dwindle the treatment gap in childhood epilepsy treatment in sub-Saharan Africa.

Though tele-neurology in Africa is in the nascent stages, this technology is being promptly adopted into the healthcare system. It has shown promise in the delivery of virtual training sessions with centres where these specialized procedures are being done, enhanced access to expert care to under-served communities through online consultation and reduced overhead costs of healthcare.

Neurosurgeons across the nation routinely operate on secondary seizures brought on by brain tumours despite the absence of epilepsy surgery centres in the nation.[17,25]

Imo State's Regions Hospital, a privately owned stroke and neuroscience facility, is the only hospital in the area equipped to provide continuous video monitoring EEG and other cutting-edge neurological diagnostic and therapeutic services.[26]

To improve epilepsy care in Nigeria, significant efforts must be made to promote and conduct extensive clinical research on the current state of epilepsy treatment. The quality of service provided, the need for ES, and the country's infrastructural gap must all be addressed. The knowledge of epilepsy treatment protocols among medical students and residents should be assessed as part of further research, allowing training modules to be tailored to specific training gaps.

CONCLUSION

Although Nigeria is far behind in ES, development of surgical programs will reduce the current treatment gap in epilepsy care. Radical, proactive steps must be taken to improve access to epilepsy care and to establish comprehensive epilepsy surgery programs in the country.

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