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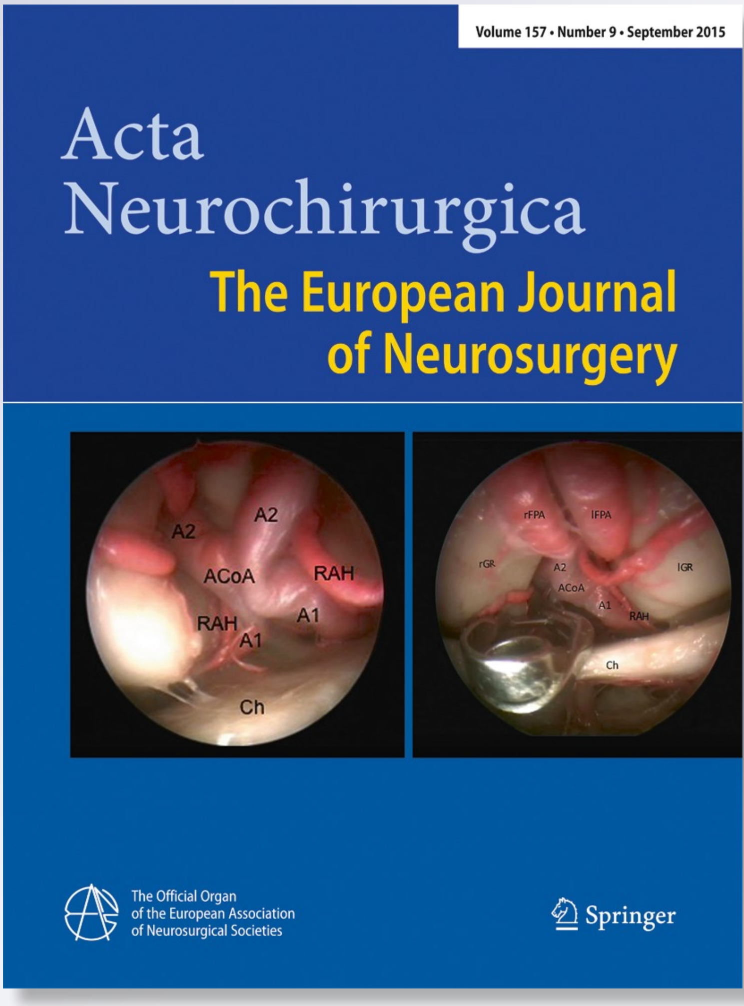

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CLINICAL ARTICLE - FUNCTIONAL

Perspectives of epilepsy surgery in resource-poor countries: a study in Georgia

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Abstract
Background To identify patients with concordant seizure semiology, interictal epileptiform discharges on standard EEG and brain MRI changes to define the patients with pharmacoresistant epilepsy (PRE) who would be suitable for epilepsy surgery according to non-invasive protocol.
Methods The medical records of the patients with epilepsy seen in Epilepsy Center of Institute of Neurology and Neuropsychology (ECINN) (Tbilisi, Georgia) were reviewed retrospectively. The diagnostic work-up included neurological examination, standard EEG, and MRI. The degree of concordance of the seizure semiology, EEG, and neuroimaging was used to determine the potential candidates for surgery. The probability of seizure freedom rate was estimated based on known predictive values of anatomical, electrophysiological, and semiological characteristics.
Results A total of 83 (25 %) patients met the criteria of PRE. Fourteen (17 %) patients had complete concordance of seizure semiology, MRI, and EEG. Out of these patients, 11 had mesial temporal sclerosis on MRI and three had focal cortical dysplasia (FCD). Estimated seizure-free surgical success rate in this group was 75–95 % without the need for further investigations. Out of 25 (30 %) non-lesional MRI cases, the concordance of seizure semiology and EEG was in nine patients with probable success rate up to 60 %. Thirteen patients (16 %) had discordant EEG and MRI data and were not suitable for surgery without further testing.
Conclusions A significant portion of PRE patients with concordant anatomical, electrophysiological, and semiological characteristics can be treated surgically in resource-limited countries. Nevertheless, most patients will still require further investigation for proper localization of epileptogenic focus.

Keywords Pharmacoresistant epilepsy · Surgical treatment · Developing country

Introduction

Epilepsy is one of the most common chronic neurological diseases, affecting more than 60 million people worldwide [25]. About two-thirds of them become seizure-free on adequate trials of tolerated, appropriately chosen antiepileptic drugs (AED), either with monotherapy or in combination [18]. Most of the patients become seizure-free on the first two AEDs and further medical treatment yields only 5 % of long-term seizure remission [28]. Unfortunately, more than 30 % of patients with epilepsy fail AEDs and are thought to have pharmacoresistant seizures (PRSs) [19]. PRS causes significant physical and psychosocial morbidity, a worsening quality of life (QOL), and leads to high mortality [2, 20]. Besides medical problems, PRSs carry both high direct and indirect costs [13] that impose a large economic burden on patients, their families, and the health care system.

The International League Against Epilepsy (ILAE) defines pharmacoresistant epilepsy (PRE) as the failure of epileptic seizures to respond to at least two AEDs that are appropriately chosen and given at adequate doses for an adequate period of time [18]. There is evidence that patients with any type of focal seizures (structural, metabolic, or of unknown etiology)

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are more commonly associated with development of pharmacoresistance than patients with generalized seizures [34]. Epileptogenic structural cortical lesions, such as hippocampal sclerosis (HS) and malformations of cortical development (MCD), are considered as major risk factors for PRS [29, 30]. Epilepsy surgery aimed at resection of these lesions is often considered a curative treatment for PRE. Detection of a well-defined lesion on MRI of the brain with concordant scalp EEG finding in a patient with medically intractable seizures is a very important predictor for successful epilepsy surgery [6, 33]. Instead of this, in discordant, non-lesional or some poorly defined lesional cases, an invasive, intracranial EEG recording remains the gold-standard procedure for better defining a seizure onset area and epileptic focus. Intracranial EEG recordings are not readily available in some countries, which causes a limitation in choosing surgical candidates defined with patients that could be assessed according to non-invasive protocol without further sophisticated investigations. Such circumstance creates skepticism about feasibility and efficiency of epilepsy surgery programs and discourages its initiation. This is more important for countries with relatively small populations and lack of sophisticated investigations where launching an epilepsy surgery program may require a previous estimation of the number of epilepsy patients eligible for surgery without invasive or additional functional investigations. This can be true for Georgia, with a population of up to 4 million [9] and where epilepsy surgery has not been developed until now.

The aim of this study is to identify the patients with concordant seizure semiology, standard EEG interictal epileptiform discharges (IED), and brain MRI changes, and to define the approximated load of patients with PRE suitable for epilepsy surgery in the countries with limited intracranial EEG and functional brain imaging technical capabilities.

Materials and methods

Data collection

Medical records of the patients with epilepsy who were seen in the Epilepsy Center of Institute of Neurology and Neuropsychology (ECINN) (Tbilisi, Georgia) and are entered in the "Epilepsy Registry" from 1 January to 31 December, 2011, were reviewed retrospectively. The diagnostic work-up besides carefully obtained history included neurological examination, standard EEG, and MRI [14]. Seizures were classified based on the ILAE classification of seizures [10]. The PRE was defined according to the ILAE consensus criteria on definition of pharmacoresistant epilepsy: failure of adequate trials of two tolerated, appropriately chosen antiepileptic drugs either as monotherapies or in combination to achieve sustained seizure freedom [18].

Seizure semiology

To evaluate seizure focus, we used semiological features with well-established lateralizing and localizing characteristics [4, 15, 22]. The following symptoms and signs were used for semiological localization of seizure onset: Mesial temporal onset seizure—abdominal aura in isolation or with automotor component that includes sensations of nausea, pain, or indescribable discomfort in the abdominal or periumbilical area; either static or with rising to the chest and throat, or descending into the lower abdominal region; Contralateral partial onset seizure—well-defined unilateral somatosensory evolving and spreading aura; Contralateral frontal onset seizure—simple motor aura of unilateral clonic or tonic movements; Contralateral hemisphere onset seizure—head and eye versive movement and sign of four with arm extension; Ipsilateral MTLE—unilateral eye blinking and nose wiping or rubbing (during or shortly after seizure termination); Hypothalamic hamartoma—gelastic seizures characterized by brief periods of laughter or grimacing with or without the subjective feeling of mirth;

EEG

At least one standard 30-min, 21-channel EEG capturing wakefulness or sleep was recorded. Hyperventilation and photic stimulation was performed during all EEG recordings. Focal and generalized interictal epileptiform discharges (IED) and focal slowing were registered. Focal IEDs were defined as sharp waves and spikes in single or rhythmic runs, focal polyspikes, and generalized polyspikes with secondary bilateral synchrony. Due to the paucity of ictal events during standard EEG recordings, ictal EEG findings were not included in the analysis.

Magnetic resonance imaging (MRI)

MRI was performed with 1.5- or 3-T high-field scanners (Magnetom Avanto and Magnetom Verio, SIEMENS, Germany). The epilepsy MRI protocol included T1(TSE)-weighted 3D axial magnetization prepared rapid gradient echo (MPRAGE) images with and without intravenous contrast application, with axial and sub-millimetric slicing coronal T2 (TSE)-weighted turbo spin-echo, coronal T2-weighted fast fluid attenuated inversion recovery (FLAIR), T2*-weighted axial and diffusion-weighted pulse sequences, slices thickness—2.0 mm. Coronal scans were oriented in the perpendicular plane to the long axis of the hippocampus.

Scoring by relevance of surgical intervention

Every case was scored according to the level of clinical, neurophysiological, and neuroimaging correlation. Each modality was assigned a one-point score. In case of full concordance between the semiology, EEG, and the MRI, the case was given three points. Each case's expectable success rate was then evaluated according to data from other studies on predictive values of surgical treatment in various degrees of overlap between anatomo-electroclinical and semiological characteristics.

Statistical analyses

Statistical analyses were performed with SPSS version 20, IBM Corp. Armonk, NY, USA. Descriptive statistics were obtained for demographic and clinical variables. Mean and deviation (SD) (in case of non-normal distribution median and IQR) were calculated for characterization of central tendencies.

We also estimated the probability of being seizure-free 1 year after surgical treatment based on publications where authors defined expected outcomes according to various combinations of predictors [1, 7, 16, 17, 23, 31]. This data was then applied to cases in our study and the approximate chance of seizure freedom was estimated. Table 1 shows approximated predicted probabilities of 1-year seizure freedom according to various combinations of predictor variables.

Results

Demographic data

In total, 334 patients were seen in the ECINN during the year of 2011. Twenty-three (7 %) individuals had idiopathic generalized epilepsy (IGE) and in the remaining 311 (93 %) cases, focal epilepsy was observed. Among those with focal epilepsies, 126 (41 %) patients had seizures within the previous 6-month period. Among them, thirty-nine (30 %) patients were non-compliant with AED treatment, and in another four patients seizures were considered as non-epileptic. The remaining 83 (25 %) patients from the initial cohort met the criteria of PRE.

The mean age of the patients with PRE was 26.4 years (SD 12.8; min 4 years; max 57 years). Fifty-four (65 %) patients were female; the median age at index seizure was 20 (IQR; 20; min 1 month; max 77 years). The mean duration of epilepsy was 17.7 years (SD 11.2).

Twenty-six (31 %) patients with PRE had a single epilepsy risk factor and one patient had more than two epilepsy risk factors. Five patients (6 %) had a family history of epilepsy in first- and/or second-degree relatives, 19 (23 %) patients had a history of perinatal hypoxic-ischemic brain damage, three patients had a history of head trauma, and 18 (21 %) patients had a history of febrile seizures. There were no clear epilepsy risk factors found in 46 (55 %) patients.

Table 1 Estimated probability of 1-year seizure freedom according to various level of concordance between clinical, EEG, and MRI findings (references for estimations below [1, 7, 16, 17, 23, 31])

Predictor variables	Predicted probability of 1-year seizure freedom or significant improvement (%)
Concordant MRI, EEG, and semiology	75–95
Concordant MRI and EEG	71–74
Single MRI focus[a]	60–70
Various combinations of discordant or semi-concordant variables[a]	5–59

[a] Predicted probabilities may vary largely according to invasive tests and functional imaging techniques used

Seizure characteristics and semiology

Ninety-six percent of patients had focal seizures with or without secondary generalization; in three cases, generalized seizures were diagnosed and in one case seizure type remained uncertain (Table 2).

EEG

EEG was performed in all 83 cases. Sharp-wave or spike discharges were observed in 78 (94 %) patients. In one case, focal non-rhythmic spikes and generalized spikes were revealed (with tonic and atonic seizures with multifocal lesions

Table 2 Seizure types and seizure semiology

Epilepsy etiology	*n* (%)
Structural	58 (70)
Unknown/cryptogenic	25 (30)
Seizure types	*n* (%)
Focal seizures	80 (96)
Simple and/or complex focal seizures	14 (18)
Focal seizures with secondary generalization	66 (82)
Generalized seizures (tonic and/or atonic)	2 (2)
Uncertain	1 (1)
Possible focus by seizure semiology	
Frontal	23 (28)
Temporal	26 (31)
Parietal	5 (6)
Occipital	1
Uncertain	19 (23)
Hypothalamic (gelastic)	2
Fronto-temporal	6 (7)
Fronto-parietal	1

on MRI). In another case, bilateral sharp-slow wave discharges were detected (patient has tonic seizures; normal 3-T MRI). For more details about localization and lateralization of EEG epileptiform abnormalities, see Table 3.

MRI

MRI investigations were performed in 83 patients. The 3-T MRI was done in 13 (16 %) individuals. MRI was non-lesional in 25 (30 %) patients. Out of the remaining 58 patients, the lobar lesions were identified in 29 patients (35 %), multilobar in 25 (30 %) patients, and midline abnormalities were found in four (5 %) patients. Two patients with a midline lesion had hypothalamic lesions. In 15 individuals, the lesion was located in the temporal lobe in 12 cases in the frontal lobe and in two patients the lesion occupied the large area in the hemisphere, extending into different lobes. For more details, see Table 4.

Concordance between EEG, MRI data, and seizure semiology

Fourteen (17 % of the whole cohort) patients had complete concordance of seizure semiology, MRI, and EEG (Table 5). Among them, in 11 (79 %) patients MRI showed mesial temporal sclerosis. The remaining three (21 %) patients had FCD. Among 25 (30 % of all participants) MRI negative cases, the concordance of seizure semiology and EEG was found in nine (36 %) patients. In 13 (16 %) patients, the EEG was discordant with a single MRI focus.

The degree of the concordance of the seizure semiology, EEG, and neuroimaging was used to determine the potential candidates for surgical intervention. The best chances of seizure freedom have cases with full concordance [14 (17 %) patients] and it is estimated as high as 75–95 %. Concordant semiology with a single well-defined MRI focus can also yield acceptable results after surgery [7 (8 %) patients]. Less success is expected in cases of MRI-negative cases. For more details on estimated probabilities of being 1 year seizure-free post-surgically, see Table 6.

Table 3 EEG findings of 83 patients with PRE

EEG findings	*n* (%)
Normal	2 (2)
Abnormal	81 (98)
Localization of epileptiform discharges	
Frontal	21 (25)
Right	13 (16)
Left	5
Bilateral	3
Temporal	28 (34)
Right	9 (11)
Left	15 (18)
Bilateral	4
Parietal	5 (6)
Right	1
Left	3
Bilateral	1
Occipital	2 (2)
Right	2
Multifocal/diffuse	22 (27)
Uncertain	3 (4)

Table 4 MRI findings in 83 patients with PRE

MRI data	*n* (%)
Normal	25 (30)
Abnormal	58 (70)
Mesial temporal sclerosis (MTS) (with lacunar lesion, 1; with encephalomalacia, 1; bilateral, 1)	15 (18)
Cortical atrophy (with leukoencephalopathy—one case)	7 (8)
Malformation of cortical development (focal cortical dysplasia, 6; heterotopia, 1)	7 (8)
Leukoencephalopathy	5 (6)
Gliosis (with arachnoid cyst, 1)	5 (6)
Glioneuronal tumor	4
Dysgenesis of the corpus callosum	2
Hypothalamic hamartoma	2
Polymicrogyria (with bilateral schizencephaly, 1)	2
Lacunar lesion	2
Tuberous sclerosis complex	2
Ulegyria	1
Postoperative cyst	1
Multiple cystic lesions	1
Encephalomalacia	1
Cerebral hemiatrophy	1

Discussion

The goal of this study was to evaluate patients with PRE that could be considered for epilepsy surgery based on semiology, standard interictal EEG findings, and MRI.

The concordance between MRI, EEG, and semiology is shown to have good predictive value for successful surgical outcome [25]. The degree of concordance differs in patients and it is not expected that all the patents would have a perfect concordance for all tests. The greater the level of concordance, the higher is the chance for patients to become seizure-free. The essence of a successful surgery is an accurate localization of an epileptic focus. There is no single test that would reliably

Table 5 MRI, EEG, and semiology in 14 patients with PRE

Case no.	Gender	Age/age at index seizure (years)	Treatment duration (years)/regimen tried	Seizure semiology	MRI finding	EEG
1	F	39/12	27/3	Epigastric aura, loss of consciousness and oral automatisms	Left hippocampal sclerosis (HS)	Sharp-slow waves in left temporal area
2	M	44/1	31/5	Epigastric aura, loss of consciousness, secondary generalized tonic-clonic seizures (SGTCS)	Left HS	Sharp-slow waves in left temporal area
3	F	17/12	5/3	Complex focal seizures (CFS), SGTCS	Focal cortical dysplasia (FCD) in right middle frontal gyrus	Sharp waves in right frontal area
4	F	37/7	17/5	Epigastric aura, CFS, SGTCS	Right HS	Sharp-slow waves in right anterior temporal area
5	F	40/22	17/3	Epigastric aura, CFS with automatisms, SGTCS	Right HS	Sharp waves in right anterior temporal area
6	F	42/7	10/2	CFS with automatisms, SGS	Right HS	Sharp waves in right anterior temporal and midfrontal areas
7	F	33/5	14/4	CFS, SGTCS	FCD in left superior frontal gyrus	Spike-waves on left fronto-polar region
8	F	32/2	30/4	Epigastric aura, CFS, SGTCS	Left HS	Sharp waves in left anterior temporal area
9	F	47/33	14/4	CFS with automatisms, SGTCS	Right HS	Sharp waves in right anterior temporal area
10	M	30/13	7/3	Epigastric aura, CFS with automatisms, SGTCS	Right HS	Sharp waves in right anterior temporal area
11	F	18/11	7/5	CFS, SGTCS	Right HS	Right temporal spike and wave discharges with frontal propagation
12	M	47/10	30/3	Epigastric aura, CFS with psychic symptoms, SGTCS	Right HS	Right anterior temporal spike and wave discharges
13	F	18/0.7	17/4	CFS with automatisms	Left HS	Sharp and slow waves in left anterior temporal area
14	M	30/18	12/6	Simple Focal Seizures (SFS), CFS and SGTCS. Status epilepticus	FCD in right middle frontal gyrus	Sharp and slow waves in right frontal area

localize epileptic focus. Therefore, the consultation of the clinical findings and the different set of neurophysiological, anatomical, and functional neuroimaging (PET and/or SPECT) is used to identify an epileptogenic area. Several studies highlight predictive value between postsurgical outcome and modes of preoperative evaluation. In patients with epilepsy originating from the posterior cortex, with concordance between lateralizing semiology and MRI findings; 74 % of the cases are expected to become seizure free after surgery. Conversely, 87 % of patients with non-lateralizing/localizing semiology are likely to continue seizures after lesionectomy [3]. More impressive results have been shown in studies of patients with mesial temporal epilepsy (MTS). Here, MRI abnormalities consistent with MTS have predictive value of 63–72 % for long-term seizure-free outcome after anterior temporal lobectomy [16]. The identification of IEDs on standard EEG recording gives additional benefit in favor of a good outcome. In such cases, presurgical identification of unilateral hippocampal atrophy together with the appropriate interictal epileptiform discharges on EEG yields 94 % positive outcome after epilepsy surgery [27].

The predictive value of the standard EEG alone on surgery outcomes is hard to establish, however, lateralized IEDs on standard EEG have a high predictive value for the correct identification of epileptogenic sites and is associated with 1-year seizure freedom after surgery [11, 12]. Persistent focal slowing in TLEs has a very high sensitivity to correct identification of the temporal origin of seizures [8]. Noe and colleagues found that the presence of interictal localized EEG discharges was the only non-invasive test associated with excellent outcome after surgery in extratemporal non-lesional epilepsy cases [24]. Similar results were observed in another study [5] that found that unilateral IEDs on scalp EEG were associated with an excellent outcome after amygdalohippocampectomy. This suggests that stable IEDs on scalp EEG is a valuable finding in prediction of outcome in patients that are estimated with non-invasive protocol.

Non-lesional cases of PREs deserve special attention. According to Téllez-Zenteno and colleagues [32], in case of non-

Table 6 Level of concordance between variables and estimated probability of seizure freedom or significant improvement after 1 year of surgery in 83 patients with PRE

Level of concordance	*n* (%)	Concordance level	Predicted surgery outcome
Single MRI focus	28 (34)		
Concordant all other variables	14 (17)	+++	75–95
Concordant semiology with MRI foci	7 (8)	++	71–74
Concordant EEG and semiology, discordant with MRI foci	2 (2)	++	60–70
No clear concordance	4 (5)	++	5–59
Multifocal MRI	30 (36)		
Concordant EEG and semiology discordant with MRI lesions	3 (4)	++	5–59
No clear concordance	27 (33)	+	5–59
MRI negative	25 (30)		
Concordant other variables	9 (11)	++	5–59
Discordant EEG and semiology	16 (19)	+	5–59

lesional MRI, 45 % of TLE and 34 % of extratemporal epilepsy patients were seizure-free after surgery.

In our study, 14 cases (17 % of a whole cohort of patients with PRE) with concordant data, all patients could have epilepsy surgery without the need for further invasive investigations, except for three patients with frontal FCD who would need intra-operative brain mapping with cortical stimulation and motor-evoked potentials or preoperative functional studies, fMRI, magnetoencephalogram (MEG) (not available yet in Georgia) for evaluation of the eloquent cortex.

When applying results to the situation in Georgia, with a prevalence of epilepsy 8.8/1000, we can consider that about 40,000 epilepsy patients could reside throughout the country [21] with about one-third of these being pharmacoresistant. Taking into consideration the rate of cases with unilateral HS in our study cohort, one would expect 400–1600 individuals being eligible for surgical treatment without the need for invasive studies. This numbers if patients are before the surgical treatment is takes off in Georgia and there will be less HS cases as the surgical treatment becomes of care in the future. In addition to this, taking into account the average incidence rate for developing countries (about 80 new cases per 100,000/year) [26], we can expect about 100 patients annually will benefit from surgical treatment. Data suggests that surgical treatment of epilepsy could be successfully launched in Georgia with some stable amount of patients that can be treated through non-invasive protocol. Further development of invasive techniques will broaden the spectrum of surgically remediable epilepsy cases that will only contribute in progress of epilepsy surgery program. The cost of treatment is an important part of such an initiative. We estimate that required average funds for surgical treatment (e.g., temporal lobectomy) would be around 4500 USD, which can be readily covered by the insurance or state programs available.

Limitations of the study

Our estimations on surgical outcome were based on studies with different methodologies used that may affect the precision of judgment and should be considered as an approximate assessment. Video EEG telemetry was not used in our study, which could have an effect on accuracy on estimation of EEG focus.

Strengths of the study

The obtained results can be effectively used for increasing the decision-makers' ability of planning epilepsy surgery services throughout the country. The estimated amount and nature of possible surgery cases will serve as a roadmap for accurate arrangement and development of dedicated medical personnel as well as for enhancement of technical capabilities. The presented results could be used by other countries with similar populations and prevalence of epilepsy to estimate the feasibility and efficiency of initiating an epilepsy surgery program.

Conclusions

Data suggests that a significant number of patients with PRE can be treated surgically even in resource-limited countries. Stemming from this, we can conclude that initiation of an epilepsy surgery program should be encouraged in Georgia. The results can also be applied to other countries with the same demographic and epidemiological characteristics in the region. However, most patients will require further investigation for proper localization of epileptogenic focus.

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Ethical standards The study was scrutinized and approved by the National Committee of Bioethics and was carried with full adherence to the principles of the Declaration of Helsinki, 1964. Before inclusion in the study, all participants gave informed consent.

Conflict of interest The funding source has not been involved in the collection, analysis and interpretation of data, in the writing of the report, or in the decision to submit the article for publication. GL, GJ and SK were paid for their job within the grant DI/40/8-313/11. None of other authors have conflict of interest to declare.

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Comments

This study is trying to establish arguments to overcome the problem of establishing an epilepsy surgery center in a country where resources to create new cost-intensive treatments is difficult. It is well known that presurgical evaluation can frequently be expensive due to the necessity to have video EEG places with round-the-clock monitoring personnel. In addition, a whole group of experts is needed, such as EEG technicians, epileptologists, experienced EEG readers, neuropsychologists, a modern era MRI, and, as another source of high expense, the technology of implanted electrode evaluations. This problem is certainly not restricted to Georgia; there are other countries in Europe and around the world that are in the same situation.

The authors have done a good job of carefully reviewing the literature and using the data obtained from the literature to identify potential candidates for epilepsy surgery from their annual patient load. They were able to identify 83 potential candidates with drug-resistant epilepsy who in theory would deserve to be evaluated if they are suitable candidates for epilepsy surgery. The paper is obviously written with the intention to convince the local authorities to invest the money for the creation of an epilepsy surgery service. The calculations are based on good data. The study was carefully done, and I think the conclusions are correct. The numbers they found are in accordance with the percentages known from other countries. The study was performed by a neurology group specialized in epileptology and is indirectly related to neurosurgery by pointing out that even with limited resources, for example no intracranial electrode placement, it is still possible to identify surgical candidates. This was done in a convincing fashion.

These arguments may be useful for other joint neurology/neurosurgery groups who want to convince their administrations to establish an epilepsy surgery center.

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The authors present a study looking to justify the setting up of an epilepsy surgery program for Georgia (population of 4 million) based on seizure semiology, inter-ictal EEG, and MRI. Temporal lobe epilepsy remains the "mainstay" of adult epilepsy surgery and the authors estimate a "pool" of over 400 cases of MTS in the country, many of which will be potential surgical candidates. Considering that surgery for MTS is one of the few neurosurgical procedures for which there is class I evidence, and with a high chance of rendering the patients seizure free (and hence being highly cost effective), this is the obvious cohort on which to initially develop the service. It is surprising that this study did not identify more glioneuronal tumors—another cohort of lesional epilepsy cases, which are potentially good surgical candidates. For left mesial temporal lesions, some form of memory assessment would add to the pre-evaluation work-up. To undertake non-lesional work on the basis of such a limited assessment may prove more challenging and less rewarding—especially when one considers the Mayo Clinic experience where only 11 % of extra-temporal non-lesional cases had an excellent outcome.

Interestingly, the rate of MTS appears to be decreasing in most developed counties and, despite guidelines, the numbers of patients receiving surgery has always fallen well short of the predicted numbers of patients who might benefit from such surgery. While the authors have supplied good evidence for the need of a service in Georgia, we suspect that once the "backlog" of cases (resulting in a high prevalence) is dealt with, the incidence of new cases coming to surgery will be more modest than that predicted by the authors.

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