Cross-sectional Study

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Microsurgery for drug resistance epilepsy due to temporal lobe lesions in a resource limited condition: a cross-sectional study

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Introduction: Epilepsy is a prevalent neurological condition that affects individuals of all ages and genders worldwide. Surgical intervention for drug-resistant epilepsy has been found to improve quality of life, with patient independence being of utmost importance.

Methods: The study was a retrospective and prospective cross-sectional study of 35 cases of drug-resistant temporal lobe epilepsy. All patients were operated on by the primary author between May 2018 and September 2022. The study evaluated various factors including clinical characteristics, electroencephalogram, magnetic resonance imaging, surgical outcomes, and histopathology.

Results: The success rate of the surgeries (74.3%) is similar to those reported in high-income countries. 51.4% underwent selective amygdalohippocampectomy for cases that localized to the mesial temporal lobe. Lateral/neocortical lesions underwent lesionectomy (48.6%). Our study found a complication rate of 17.1%: meningitis (8.5%), trainset focal paralysis (2.9%), and soft tissue infection (5.7%). There were no mortalities.

Conclusions: The article showcases an international collaborative effort that demonstrates the possibility of providing highly effective and safe surgical care for temporal lobe epilepsy even in low-resource environments. The authors hope that this model can be replicated in other areas with similar resource limitations.

Keywords: drug resistance epilepsy, lesionectomy, low-income, selective amygdalohippocampectomy, temporal mesial sclerosis

Introduction

Epilepsy is a prevalent neurological condition that affects individuals of all ages and sexes worldwide. Around 20–30% of individuals with epilepsy suffer from drug-resistant epilepsy[1,2]. With 80% of cases attributed to it, temporal lobe epilepsy (TLE) is the most frequent form of epilepsy among adults. Furthermore, it has the highest rate of drug resistance, frequently leading to surgical intervention being necessary[3,4]. A patient with drug-resistant epilepsy is defined as someone who has not achieved sustained seizure freedom despite undergoing adequate trials of at least two tolerated, appropriately chosen, and properly administered antiepileptic drug regimens. This includes both monotherapies and combinations of medications. The diagnosis of drug-resistant epilepsy is based on the definition established by the International League Against Epilepsy (ILAE)[5]. Drug-resistant epilepsy is often caused by lesions in the temporal lobe, with hippocampal sclerosis, focal cortical dysplasia, and low-grade brain tumours being the most common. Among these, hippocampal sclerosis is the primary cause of lesions in the medial temporal lobe that lead to drug-resistant epilepsy[6,7]. TLE is treated with medications, resection surgery, and vagus nerve stimulation (VNS). Epilepsy surgery should be considered in all patients with refractory epilepsy. Meanwhile, VNS provides palliation of seizure reduction for patients with medically refractory epilepsy, this is an expensive treatment and is used in high-income countries. VNS is indicated for symptomatic localization-related epilepsy with multiple and bilateral independent foci, symptomatic generalized epilepsy with diffuse epileptogenic abnormalities, refractory idiopathic generalized epilepsy, failed

HIGHLIGHTS

- The article showcases an international collaborative effort that demonstrates the possibility of providing highly effective and safe surgical care for temporal lobe epilepsy even in low-resource environments like Vietnam.
- The authors hope that this model can be replicated in other areas with similar resource limitations.

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intracranial epilepsy surgery, and other several reasons of contraindications to epilepsy surgery[8,9].

Surgery is a safe and highly effective treatment option for TLE, with reported rates of seizure cessation ranging from 69 to 90% after surgery. Long-term follow-up studies of up to 12 years have demonstrated seizure cessation rates of 76.2% and 70.8%, respectively[10,11,12]. To evaluate the impact of surgical intervention on the quality of life of individuals with epilepsy caused by temporal lobe damage, various assessment tools such as 36-item Short Form Survey (SF-36) questionnaire or QOLIE-89-/QOLIE-31 scales can be used. The SF-36 questionnaire, which is widely used in many treatment centres globally, comprises 36 questions categorized into eight domains such as physical health, mental health, social functioning, pain, energy, and general health, among others, and can be administered both before and after surgery[13,14]. Numerous epilepsy treatment centres worldwide have conducted research on the impact of epilepsy on quality of life. Seizure frequency, antiepileptic drugs, and comorbidities have been identified as factors that negatively affect quality of life. However, surgical intervention for drug-resistant epilepsy has been found to improve quality of life, with patient independence being of utmost importance.

Vietnam is a member of the ASEAN organization and is classified as a low-middle-income country, with a population of approximately 99 million people[15]. In Vietnam, the incidence of epilepsy is 4.4 per 1000 people, with a 95% CI ranging from 3.6 to 5.2[16]. A meta-analysis reported that the incidence of epilepsy in Vietnam is four times higher (4.4 per 1000 people, 95% CI 3.6–5.2) than in Singapore (0.75 per 1000 people, 95% CI 0.73–0.77). However, the incidence of epilepsy in Vietnam is quite similar to that of the United States (4.61 per 1000 people, 95% CI 4.34–4.9[17]. Epilepsy treatment in Vietnam has not received enough attention, and there is still a large treatment gap[18].

In Vietnam, after obtaining a basic medical degree, individuals can pursue residency programs in neurosurgery. However, specialized training in subspecialties such as epilepsy and preoperative evaluation is currently not available in the country. To establish an epilepsy surgery program in Vietnam, neurosurgeons and neurologists have received training as epilepsy fellows at renowned epilepsy centres in Europe. Various educational programs and courses are available for neurologists and neurosurgeons, covering a range of subjects including electroencephalogram (EEG) and Stereo Electro Encephalo Graphy interpretation, refractory epilepsy management, preoperative evaluation of epilepsy patients, and surgical techniques like amygdalohippocampectomy, corpus callosotomy, hamartoma hypothalamussurgery, and functional hemispherectomy. These programs aim to provide comprehensive training on these specific areas to enhance the knowledge and skills of healthcare professionals in the field of epilepsy diagnosis, evaluation, and surgical interventions[19].

The focus of this article is on the clinical characteristics and early outcomes of surgery for drug-resistant epilepsy caused by temporal lobe lesions in a low-resource environment.

Methods

The study was a retrospective and prospective cross-sectional study of 35 cases of drug-resistant TLE. The study used the χ^2 test for dichotomous variables and *t*-test for continuous variables, and surgical outcomes were classified using the Engel classification (Engel, 1993). All patients were operated on by the primary author between May 2018 and September 2022. The study evaluated various factors including clinical characteristics, electroencephalogram, magnetic resonance imaging, surgical outcomes, and histopathology. Patients were excluded from the study if they had not completed two medication-compliant trials of at least 3 months each, had extra-temporal or bitemporal ictal onset, or if the clinical semiology, interictal EEG, and MRI were not all concordant in identifying the ictal onset to the same temporal lobe. This was important due to limited resources and bed space, which made it difficult to perform protracted monitoring with intracranial depth electrodes or cortical grids to further localize the seizure focus.

The selective amygdalohippocampectomy (SAH) technique is indicated for cases of hippocampal sclerosis as detected on MRI. This procedure focuses on the selective removal of the amygdala and hippocampus, which are regions commonly affected by hippocampal sclerosis. On the other hand, the lesionectomy technique is recommended when MRI reveals the presence of a tumour or dysplasia. In such cases, the lesionectomy involves the surgical excision of the identified abnormal lesion in order to alleviate the associated epileptic activity[5,8,9].

Formal consent was obtained from all participants, and the study was approved by the institutional review board (IRB).

Table 1

Demographic of the subject of study.

Character	Quantity, *n* (%)
Sex	
Male	22 (62.9)
Female	13 (37.1)
Age group	
< 10	3 (8.6)
10–19	11 (31.4)
20–29	12 (34.3)
30–39	9 (25.7)
> 40	0
Age of onset of seizures	
< 10	20 (57.1)
10–19	11 (31.4)
20–29	3 (8.6)
30–39	1 (2.9)
> 40	0

Table 2

Relationship between age of onset of seizures and age of surgery.

Age of patients undergoing surgery (years old) Age of patients onset of seizures (years old)	< 10	10–19	20–29	30–39	*P*
< 10	100	90.9	33.3	33.3	0.037
10–19	0	9.1	50	44.4	
20–29	0	0	16,7	11.1	
30–39	0	0	0	11.1	
Total (%)	100	100	100	100	

Table 3

Drug-resistant temporal seizure characteristics table.

Seizure type, *n* (%)	
Focal and aware	1 (2.9)
Focal, impaired awareness, non-motor onset (absence)	12 (34.3)
Focal, impaired awareness, motor symptoms	22 (62.8)
Generalized seizures	0
Onset with auras, *n* (%)	
Auras	14 (40)
No auras	21 (60)

Preoperative assessment

In addition to the MRI scan according to the ILAE protocol[20], each patient also received a 16 or 32-channel scalp EEG with at least 30 min of recording time. Memory assessment was conducted using the Weschler scale, which is a commonly used tool for assessing various aspects of cognitive function. Quality-of-life assessment was also performed using the short set of questions from the SF-36, which is a standardized questionnaire used to assess overall health and well-being.

This means that after the surgery, patients undergo follow-up evaluations, including a clinical examination, electroencephalography, and cranial magnetic resonance imaging at postoperative 1 month, 6 months, and 1 year. These evaluations help to monitor the patient's progress and ensure that they are recovering properly.

This prospective, cross-sectional study has been reported in line with the STROCSS guideline[21]

Results

Demographic of the subject of study

The demographic and clinical characteristics of our 35-patient cohort are listed in (Table 1). The male to female ratio was ~1.5:1, and all patients were under 40 years old, with those between 10 and 29 years old accounting for the majority (65.7%) of patients. The age of onset of epilepsy was typically under 10 years old for the majority of patients (57.1%) (Table 2).

Table 4

Surgical methods.

Surgical methods		
Selective amygdalohippocampectomy (SAH)	18	51.4
Lesionectomy	17	48.6
The amount of blood transfusion during surgery		
0 units	35	100
1–2 units	0	0
Total operating time		
< 4 h	17	48.6
4–6 h	18	51.4
Postoperative complications		
Meningitis	3	8.5
Soft tissue infections	2	5.7
Focal paralysis	1	2.9
Death	0	0

Table 5

Classification of postoperative seizures.

Engel outcome scale	**No. patients**	**Ratio**
Free of disabling seizures (Class I)	26	74.3
Rare disabling seizures (Class II)	8	22.9
Worthwhile improvement (Class III)	1	2.8
No worthwhile improvement (Class IV)	0	0
Total	35	100

There was a difference in the age of patients' onset of seizures with the age of patients undergoing surgery which was statistically significant with *P* less than0,05 (95% CI).

Clinical semiology of drug-resistant TLE

All seizures were focal with all but 1 being associated with impaired awareness. Forty percent of patients had auras (Table 3).

Surgical methods for treating drug-resistant epilepsy

51.4% underwent SAH for cases that localized to the mesial temporal lobe. Lateral/neocortical lesions underwent lesionectomy (48.6%). The duration of surgery was less than 4 h in 48.6% of cases. No blood transfusions were needed. There were 6 postoperative complications (17.1%): meningitis (8.5%), trainset focal paralysis (2.9%), and soft tissue infection (5.7%). There were no mortalities (Table 4).

Early surgical outcome

After surgery 74.3% achieved Engel I seizure freedom, the remaining cases had diminished but still present seizures (25,7%) (Tables 5 – 7).

We recognized no association between duration of epilepsy with seizure outcome ($P > 0,05$).

The results presented in the table suggest that there was a statistically significant improvement in the quality-of-life score, as well as a significant reduction in seizure frequency after surgery. The mean quality of life score increased from 50 to 66, indicating a substantial improvement in patients' overall quality of life. This improvement was statistically significant for physical health ($P = 0.02$), mental health ($P < 0.0001$), and total ($P = 0.001$) scores. Additionally, the surgery was highly effective in reducing seizure frequency, with the number of seizures per month decreasing significantly from 12 to 0. Overall, these results sug-

Table 6

Relationship between the duration of epilepsy with seizure outcome.

	Seizure-free		**Seizure reduction**		**Total**		
Duration of epilepsy (years)	**No. patients**	**%**	**No. patients**	**%**	***n***	**%**	***P* value**
< 10	8	61.5	5	38.5	13	100	0.171
≥ 10	15	83.3	3	16.7	18	100	
Total	23	74.2	8	25.8	31	100	

Table 7

Changes in quality of life and seizure frequency before and after surgery.

	Pre-surgery ($n=35$)		Post-surgery ($n=35$)		
	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	*P* value
Quality of life					
Physical health	51.8 (20)	44.38 (36.7–74.8)	62.7 (19.8)	63.7 (50.8–74.8)	0.02
Mental health	49.4 (20.6)	46.5 (29.6–66.7)	69.6 (20.6)	70.7 (62–85.6)	< 0.0001
Total	50.6 (18.9)	43.83 (35.7–70.8)	66.2 (18.9)	66.8 (54.2–76.5)	< 0.0001
No. seizures/months	65.1 (94.3)	12 (5–120)	7.3 (35.6)	0 (0–1)	0.001

IQR, interquartile range.

gest that surgery for drug-resistant TLE due to temporal lobe lesions in a low-resource environment can lead to significant improvements in quality of life and seizure control.

Discussion

The study discusses the outcomes of 35 patients who underwent surgery for TLE in a low-resource setting. The surgeries, which included SAH and temporal lesion resection, resulted in significant improvement in postoperative seizure control and minimal complications. The success rate of the surgeries (74.3%) is similar to those reported in high-income countries, such as Yaşargil and colleagues and Li and colleagues (Table 8).

Our research shows that surgery has a significant positive impact on the quality of life of patients, improving both physical and mental health aspects. This finding aligns with similar studies conducted worldwide. For instance, a long-term retrospective follow-up study of 50 patients with internal temporal lobe facial fibrosis who underwent surgery at the Royal Melbourne Hospital in Australia, reported a statistically significant improvement in the patients' quality of life[26]. Moreover, there is another study from Sweden, which was a prospective long-term follow-up study conducted over a period of 2–14 years in 68 patients with drug-resistant epilepsy, of which 58 patients underwent temporal lobe surgery. The study demonstrated a clear improvement in quality of life, as assessed on the SF-36 scale, which remained stable throughout the follow-up period[27]. Consistent with prior research, our study found that surgery leads to improved seizure control and serves as a predictor for better quality of life[28]. The results of our study indicate that there was no significant relationship between seizure control and quality of life before surgery. However, this lack of association may be due to the small number of patients in our study. Previous research using multivariate analysis has demonstrated a strong correlation between improved seizure control after surgery and an enhanced quality of life[29,30,31].

Our study found a complication rate of 17.1%, which is similar to complication rates reported in other studies involving surgery for drug-resistant TLE[32,33]. The study observed a higher incidence of infections, with ~15% infection rate, which included three cases of meningitis and two soft tissue infections. However, all these cases responded well to conservative antibiotic treatment. The higher incidence of infections could be due to difficulties in maintaining sterility in an operating room that uses drapes and surgical gowns that are repeatedly reused. This higher infection rate is not consistent with rates reported in high-income countries, where postoperative meningitis accounted for 6.6% of cases, and superficial incisional infections accounted for 1%[34].

The burden of epilepsy, including its prevalence, morbidity, and mortality, is concentrated in low-resource regions of the world, accounting for about 80% of cases[35]. However, epilepsy surgery programs in these areas often face significant challenges and have worse outcomes compared to those in high-income countries[36,37]. A paediatric epilepsy program has been established successfully, similar to our adult program, with the help of international collaboration and support[37]. Other countries such as Thailand[38] should be acknowledged as successful examples and models to follow.

Our research study has certain limitations that should be acknowledged. Firstly, there was no control group included, which restricts our ability to compare the outcomes with a reference or non-intervention group. Secondly, the number of cases included in our study was relatively low, which may limit the generalizability and statistical power of our findings.

To overcome these limitations and strengthen the evidence presented in the medical literature, future research should aim to conduct more comprehensive studies with larger sample sizes and incorporate a control group. This would allow for better comparison and validation of the results, leading to more reliable and robust conclusions.

Table 8

Engel outcome scale.

Authors	No. patients	Surgical approach	Engel I (free of disabling seizures) (%)
Our series (2023)	35	SAH (18) Lesionectomy (17)	74.3
Li. (2019)[22]	131	Temporal lobe surgery	78.6
Alonso Vanegas *et al.*[23]	Review from series articles	SAH Cortico-amygdalohippocampectomy	65–69
Yaşargil *et al.*[24]	73	SAH	75.3
Weibe *et al.*[25]	40	Anterior temporal lobectomy	58

SAH, selective amygdalohippocampectomy.

Conclusion

The article showcases an international collaborative effort that demonstrates the possibility of providing highly effective and safe surgical care for TLE even in low-resource environments. The authors hope that this model can be replicated in other areas with similar resource limitations.

Ethical approval

This study was approved by Viet Nam Military Medical University, Board of Directors of Miliraty Hospital 103 and Viet Duc University Hospital.

Consent

Written informed consent was obtained from the patient for publication of this case series study and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

V.D.T.: visualization, writing—original draft, writing—review and editing. B.T.N.: conceptualization, resources, supervision. H. V.D.: conceptualization, methodology, investigation, supervision. T.A.N.: visualization, writing—original draft, writing—review and editing. P.X.N.: conceptualization, methodology, investigation. H.V.V.: conceptualization, methodology, investigation, supervision. H.T.C.: conceptualization, methodology, investigation, writing—original draft, writing—review and editing, visualization

Conflicts of interest disclosure

None.

Research registration unique identifying number (UIN)

Not applicable—his is a case series study, not a systematic review or meta-analysis. Moreover, we attest that it is not a 'first in man' study, either.

Guarantor

Hung Thanh Chu.

Data availability statement

The authors declared that datasets were available upon reasonable request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

References

[1] Kwan P, Brodie MJ. Early identification of refractory epilepsy. N Engl J Med 2000;342:314–9.
[2] Pati S, Alexopoulos AV. Pharmacoresistant epilepsy: from pathogenesis to current and emerging therapies. Cleve Clin J Med 2010;77:457–67.
[3] ENGEL JRJ. Mesial temporal lobe epilepsy: what have we learned? Neuroscientist 2001;7:340–52.
[4] Semah F, Picot MC, Adam C, *et al*. Is the underlying cause of epilepsy a major prognostic factor for recurrence. Neurology 1998;51:1256–62.
[5] Kwan P, Arzimanoglou A, Berg AT, *et al*. Definition of drug resistant epilepsy: consensus proposal by the ad hoc Task Force of the ILAE Commission on Therapeutic Strategies. Epilepsia 2010;51:1069–77.
[6] Luan L, Sun Y, Yang K. Surgical strategy for temporal lobe epilepsy with dual pathology and incomplete evidence from EEG and neuroimaging. Exp Ther Med 2018;16:4886–92.
[7] Falconer MA, Meyer A, Hill D, *et al*. Treatment of temporal-lobe epilepsy by temporal lobectomy a survey of findings and results. Lancet 1955;265: 827–35.
[8] Devinsky O. Diagnosis and treatment of temporal lobe epilepsy. Rev Neurol Dis 2004;1:2–9.
[9] Yamamoto T. Vagus nerve stimulation therapy: indications, programing, and outcomes. Neurol Med Chir (Tokyo) 2015;55:407–15.
[10] Olivier A. Transcortical selective amygdalohippocampectomy in temporal lobe epilepsy. Can J Neurol Sci J Can Sci Neurol 2000;27 suppl 1: S68–76; discussion S92-96.
[11] Tanriverdi T, Olivier A, Poulin N, *et al*. Long-term seizure outcome after mesial temporal lobe epilepsy surgery: corticalamygdalohippocampectomy versus selective amygdalohippocampectomy. J Neurosurg 2008;108:517–24.
[12] Tanriverdi T, Poulin N, Olivier A. Life 12 years after temporal lobe epilepsy surgery: a long-term, prospective clinical study. Seizure 2008;17: 339–49.
[13] Aydemir N, Özkara Ç, Canbeyli R, *et al*. Changes in quality of life and self-perspective related to surgery in patients with temporal lobe epilepsy. Epilepsy Behav 2004;5:735–42.
[14] Malmgren K, Sullivan M, Ekstedt G, *et al*. Health-related quality of life after epilepsy surgery: a Swedish multicenter study. Epilepsia 1997;38: 830–8.
[15] Vietnam Population (2023) - Worldometer. Accessed 29 June 2023. https://www.worldometers.info/world-population/vietnam-population/
[16] Tuan NA, Cuong LQ, Allebeck P, *et al*. The incidence of epilepsy in a rural district of Vietnam: a community-based epidemiologic study. Epilepsia 2010;51:2377–83.
[17] Fiest KM, Sauro KM, Wiebe S, *et al*. Prevalence and incidence of epilepsy: a systematic review and meta-analysis of international studies. Neurology 2017;88:296–303.
[18] Tuan NA, Tomson T, Allebeck P, *et al*. The treatment gap of epilepsy in a rural district of Vietnam: a study from the EPIBAVI project. Epilepsia 2009;50:2320–3.
[19] Roxas A, Mehndiratta MM, Bornstein N, *et al*. The professional practice and training of neurology in the Asian and Oceanian Region: A cross-sectional survey by the Asian and Oceanian Association of Neurology (AOAN. J Neurol Sci 2017;382:108–15.
[20] Wellmer J, Quesada CM, Rothe L, *et al*. Proposal for a magnetic resonance imaging protocol for the detection of epileptogenic lesions at early outpatient stages. Epilepsia 2013;54:1977–87.
[21] Mathew G, Agha R, Albrecht J, *et al*. STROCSS 2021: Strengthening the reporting of cohort, cross-sectional and case-control studies in surgery. Ann Med Surg 2021;72:103026.
[22] Li W, Hao N, Liu W, *et al*. The experience of the multidisciplinary team in epilepsy management from a resource-limited country. Epilepsia Open. 2018;4:85–91.
[23] Alonso Vanegas MA, Lew SM, Morino M, *et al*. Microsurgical techniques in temporal lobe epilepsy. Epilepsia 2017;58(S1):10–8.
[24] Yaşargil MG, Krayenbühl N, Roth P, *et al*. The selective amygdalohippocampectomy for intractable temporal limbic seizures. J Neurosurg 2010;112:168–85.
[25] Wiebe S, Blume WT, Girvin JP, *et al*. Effectiveness and Efficiency of Surgery for Temporal Lobe Epilepsy Study Group. A randomized,

controlled trial of surgery for temporal-lobe epilepsy. N Engl J Med 2001;345:311–8.
[26] Lowe AJ, David E, Kilpatrick CJ, *et al*. Epilepsy surgery for pathologically proven hippocampal sclerosis provides long-term seizure control and improved quality of life. Epilepsia 2004;45:237–42.
[27] Edelvik A, Taft C, Ekstedt G, *et al*. Health-related quality of life and emotional well-being after epilepsy surgery: a prospective, controlled, long-term follow-up. Epilepsia 2017;58:1706–15.
[28] Pauli C, Thais ME, de O, *et al*. Predictors of quality of life in patients with refractory mesial temporal lobe epilepsy. Epilepsy Behav 2012;25:208–13.
[29] Pauli C, Schwarzbold ML, Diaz AP, *et al*. Predictors of meaningful improvement in quality of life after temporal lobe epilepsy surgery: a prospective study. Epilepsia 2017;58:755–63.
[30] Dias LA, Angelis G, de, Teixeira WA, *et al*. Long-term seizure, quality of life, depression, and verbal memory outcomes in a controlled mesial temporal lobe epilepsy surgical series using Portuguese-Validated Instruments. World Neurosurg 2017;104:411–7.
[31] Seiam AHR, Dhaliwal H, Wiebe S. Determinants of quality of life after epilepsy surgery: systematic review and evidence summary. Epilepsy Behav 2011;21:441–5.
[32] Mathon B, Navarro V, Bielle F, *et al*. Complications after surgery for mesial temporal lobe epilepsy associated with hippocampal sclerosis. World Neurosurg 2017;102:639–650.e2.
[33] Lee JH, Hwang YS, Shin JJ, *et al*. Surgical complications of epilepsy surgery procedures: experience of 179 procedures in a single institute. J Korean Neurosurg Soc 2008;44:234–9.
[34] Hader WJ, Tellez-Zenteno J, Metcalfe A, *et al*. Complications of epilepsy surgery—a systematic review of focal surgical resections and invasive EEG monitoring. Epilepsia 2013;54:840–7.
[35] Newton CR, Garcia HH. Epilepsy in poor regions of the world. Lancet 2012;380:1193–201.
[36] Rocque BG, Davis MC, McClugage SG, *et al*. Surgical treatment of epilepsy in Vietnam: program development and international collaboration. Neurosurg Focus 2018;45:E3.
[37] Fong SL, Suppiah PD, Tee SK, *et al*. Seizure remission rates remain low in a resource-limited country, a multicentre comparison study in Malaysia. J Clin Neurosci Off J Neurosurg Soc Australas 2022;102:60–4.
[38] Kanchanatawan B, Kasalak R. Quality of life in Thai intractable epileptic patients with and without surgery. J Med Assoc Thail Chotmaihet Thangphaet 2012;95:1232–8.