Prevalence of Epilepsy in a Rural District of Central Lao PDR

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Key Words
Epilepsy, prevalence \cdot Epilepsy, door-to-door survey \cdot Epilepsy, questionnaire \cdot Epilepsy, Lao PDR

Abstract

\textbf{Purpose:} To assess the prevalence of epilepsy in a rural district of Lao PDR and to describe the clinical and epidemiological profile of the disease. \textbf{Methods:} Door-to-door screening was performed on the entire population of 8 randomly selected villages in the Hinheub district, using an internationally validated and standardized questionnaire. Additional passive case detection was performed through village key informants. Suspected epilepsy patients identified by the questionnaire were revisited and examined by an experienced neurologist on two follow-up visits. The confirmation of epilepsy was based only on an in-depth clinical examination. Electroencephalograms were performed at the district health care center. \textbf{Results:} In the 8 villages, 277 suspected cases of epilepsy were identified among 4,310 interviewed subjects; 194 of whom (70\%) underwent a clinical examination by a neurologist during the first visit while 65 of 83 remaining suspected cases were seen on the second confirmation visit. Twenty-seven persons with epilepsy were identified. Six additional patients were diagnosed in 219 self-referred subjects. An overall prevalence of 7.7 cases of epilepsy per thousand inhabitants was calculated (95\% CI 5.3–10.7). Generalized epilepsy (21 cases, 63.6\%) was commoner than partial epilepsy (9 cases, 27.3\%). The remaining 3 cases (9.1\%) were not-classifiable as either generalized or partial. EEG abnormal findings were found in 12 of the 24 patients (50.0\%) who had an EEG registration. \textbf{Conclusions:} This is the first study in Lao PDR to estimate the prevalence of epilepsy. Compared to Western countries it shows a pattern towards a higher prevalence.

Introduction

Epilepsy is a chronic neurological disorder. It is a ubiquitous and multifactorial disease, leading to serious handicaps with major socioeconomic consequences. It has been estimated that the mean prevalence of active epilepsy worldwide is approximately 8\% of the general population [1]. A high burden of this disease is found in developing countries where prevalence rates are between 10 and 40\% [2–4]. Three-quarters of the 50 million patients with epilepsy worldwide live in poor countries and more than 80\% are found in the tropics. It is estimated that 80–94\% are not adequately treated [5].
In some Asian countries, in particular in South-East Asia, the importance of the disease has not been well documented. Studies in Japan, China and Singapore suggest prevalences between 3.8 and 7.3‰ (table 1) which are similar to the average global figure [6–12].

In Lao PDR, data on epilepsy is scarce and crucial epidemiological data for the development of a national control program is currently lacking. Lao PDR is a tropical country with a high burden of parasitic diseases affecting the nervous system suggesting that a high prevalence of epilepsy would be expected.

The aim of our study was to estimate the prevalence of and to describe clinical and epidemiological features of epilepsy in a rural district of Lao PDR.

Methods

Study Population

District Hinheub (Vientiane Province) is located in the center of the country, 120 km north of the capital Vientiane (see map, fig. 1a,b). It is a mountainous region area of 1,414 km² containing 49 villages and 23,788 inhabitants (census data 2003). Some villages are accessible only in the dry season. There are 3 ethnic groups (52.7% Lao-Theung, 43.9% Lao-Loum and 3.4% Lao-Soung). The official Lao language is spoken by most people. However, minority groups and in particular the elderly segment of the population only speak basic Lao. The economy of the district is dominated by subsistence rice farming and pig-rearing is very common. A district hospital is present in Hinheub, the capital of the district. Sixteen health care professionals work in the 4 subdivisions of the district.

![Map of District Hinheub](image)

**Fig. 1. a** Map of Lao PDR and the Vientiane Province (black). **b** Map of District Hinheub and the 8 villages studied.

<table>
<thead>
<tr>
<th>Country</th>
<th>Group (first author)</th>
<th>Year</th>
<th>n</th>
<th>p (%)</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>China (6 cities)</td>
<td>Li [6]</td>
<td>1985</td>
<td>63,195</td>
<td>4.4</td>
<td>Door-to-door survey</td>
</tr>
<tr>
<td>China (Shanghai)</td>
<td>Huang [7]</td>
<td>2002</td>
<td>48,628</td>
<td>3.6</td>
<td>Door-to-door survey</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Fong [9]</td>
<td>2003</td>
<td>475,900*</td>
<td>1.5</td>
<td>Adult patients (≥ 15 years)</td>
</tr>
<tr>
<td>Singapore</td>
<td>Loh [10]</td>
<td>1997</td>
<td>20,542</td>
<td>5.0</td>
<td>Men at 18 years old</td>
</tr>
</tbody>
</table>

n = Target population; p = prevalence. * Estimated population covered by hospital.
Eight of 49 villages of the Hinheub district (fig. 1a, b) were selected by a simple random sampling procedure. All 4,310 inhabitants, of all ages, were included in the screening process.

Ethical approval was obtained from the Ministry of Health, Lao PDR. Oral informed consent was obtained from all authorities involved and from all individuals prior to enrolment. Parents or caretakers answered for their children.

Definitions

Epilepsy was defined as a condition characterized by recurrent (two or more) epileptic seizures, unprovoked by any immediate identified cause. Multiple seizures occurring in a 24-hour period were considered as a single event. An episode of status epilepticus was considered as a single event. Individuals who have had only febrile seizures or only neonatal seizures were excluded from this category [13].

Active epilepsy was defined as a person with epilepsy who had had at least one epileptic seizure in the previous 5 years, regardless of antiepileptic drug treatment [13]. A person who answered positively to at least one of the 5 questions of the screening questionnaire (see below) was considered as a suspected epilepsy case.

Design

A two-stage approach was used to identify patients with epilepsy in the community (fig. 2). First, through a door-to-door survey, a screening questionnaire was used to find suspected cases of epilepsy. Second, the identified suspected cases were examined by a neurologist for confirmation of the presence of epilepsy (confirmation visit). Self-referred patients were accepted for clinical examination at the confirmation visits.

Screening Phase. During the door-to-door survey, all inhabitants of the 8 target villages were interviewed by a trained medical doctor, using an internationally validated questionnaire comprised of 5 questions [14]. An English version of the questionnaire is provided in the Appendix. The sensitivity of the screening questionnaire ranges between 85 and 95% and the specificity between 50 and 65% [4]. Six Laotian general practitioners participated and performed the screening. All were trained by the principal investigator. To assure the maximum sensitivity, they were asked to keep strictly to the questionnaire. Through daily meetings, they assured that working procedures remained standardized throughout the implementation. In particular, practitioners verified that all subjects correctly understood the questions and that these questions were asked in the Lao language. If necessary, an interpreter trans-
lated the questions into an ethnic language (Lao Theung or Lao Soung). Mothers or care-takers were questioned instead of their children (up to 10 years).

Name, age, gender, and address were taken from all interviewed persons. No additional information was collected.

Key informants in all villages such as head of villages, Buddhist monks, village health volunteers and teachers were informed that people suspected for epilepsy could be examined free of charge by a neurologist on the day of the confirmation visits.

Confirmation of Suspected Patient with Epilepsy. All suspected cases were examined by a neurologist. A neurological clinical examination and an in-depth interview were performed by the specialist with the assistance of a trained Laotian generalist. If necessary, an interpreter assisted the examination.

An electroencephalogram (EEG) was performed on the clinically confirmed cases of epilepsy in the district hospital. The monopolar and the full bipolar charges, following the classical disposition of a 21-electrode system (10/20), were saved by an IBM digital EEG monitor (Medatec Brainnet II®). Hyperventilation during 3 min was used as an activation method. Intermittent photic stimulation was not used.

The diagnosis of epilepsy was based on the clinical symptoms only; EEG abnormalities were not included. All suspected cases not examined on the first confirmation survey were invited for a second visit (for the clinical confirmation only).

Data Management and Analysis
The data were entered in EpiData freeware (www.epidata.dk) and analyzed with Stata 8.2 (www.stata.com). The results are presented using means and frequencies. Confidence intervals were calculated at the 5% risk level.

Results
Prevalence of Active Epilepsy
The study procedure and the detailed results of the screening survey and confirmation visits are provided in figure 2. From a study population of 4,310, we identified 33 patients with active epilepsy yielding an overall prevalence of 7.7‰ (95% CI 5.3–10.7).

Twenty-seven patients with epilepsy were diagnosed among the 277 suspected cases identified in the screening procedure. Twenty-five were found during the first confirmation visits and 2 patients during the second confirmation round. Six patients were found among the 219 self-referred individuals. The positivity rate for epilepsy was 12.9% among the 194 suspected examined first; this was more than 4 times higher than among the suspected cases examined during the second confirmation visit and among the self-referred patients.

In total, 93.5% of the suspected cases were seen through the two confirmation visits. 81.8% of epilepsy patients were found by the questionnaire screening approach. The remaining cases (19.2%) were diagnosed in self-referred patients. A substantial variation of epilepsy prevalence was observed in the villages, ranging from 3.4 to 15.9‰ (table 2).

Diagnosis of Suspected Patients with Epilepsy
The diagnosis of the suspected cases not confirmed as active epilepsy were: febrile seizures (30%); frisson or tremble due to fever (10%); loss of consciousness or syncope in patients with hypotension, anemia or malnutrition (15%); migraines with aura (ophthalmic or aphasis migraines) which were mistaken as partial epilepsy (3%); an essential tremor confused with myoclonia (1%); an unilateral Parkinson with tremor form (1%); buzzing ears confused with auditory hallucinations (5%); beriberi cases suspected with digestive complaint, dysesthesia and hypotonia (5%); disparate affections without any relationship to epilepsy (various headache, pains). In these cases, patients seemed to respond affirmatively to screen-
ing phase questions in order to obtain a free consultation (30%).

Description of Patients with Epilepsy

Demographic Features. Twenty of 33 epilepsy patients (60.6%) were male. The median age was 20 years. The most frequent age range was 11–20 years (14 of 33 cases, 42.4%). Children <15 years represented 27.3% of the cases (9 cases). Twenty-four percent were school-children and all other patients were farmers. Two patients (6.1%) reported not being able to work. Twenty-four cases (72.7%) lived with their parents. Thirty patients (90.9%) were Lao Theung. The remaining 3 (9.1%) belonged to the Lao Loum ethnic group. Eleven patients were Animist (33.3%), 12 were Buddhist (36.4%) and 10 were Christians.

Medical History and Environmental Data. Four patients (12.1%) had a family history of epilepsy. Four patients (12.1%) had had a head injury before epilepsy onset and 4 had associated mental retardation. Five patients (15.2%) reported antecedent of severe disease with loss of consciousness and leading to hospitalization.

More than three-quarters (75.8%) of the patients had a latrine in their household but only 2 patients (6.1%) reported using it frequently. Twenty-two patients (66.7%) used their latrines sporadically while the remaining 11 patients (33.3%) did not. Twenty-eight patients were stock-breeders, 13 of whom raised pigs in their households. Ten patients ate raw meat occasionally, of which 2 did so regularly. Eighteen (54.5%) patients reported consuming raw vegetables. Thirteen patients (39.7%) used human waste as fertilizer in their vegetable farm.

Clinical Description. Generalized epilepsy (21 cases, 63.6%) was more common than partial epilepsy (9 cases, 27.3%). The remaining 3 cases (9.1%) could not be classified as either generalized or partial. Twelve cases (36.4%) had more than one seizure type. The subclassification was as follows: 63.6% (21 cases) had generalized tonic-clonic seizures, 3.0% (1 case) had generalized myoclonic seizures, 21.2% (7 cases) had absences, 21.2% (7 cases) had partial seizures with a secondary generalization, 24.2% (8 cases) had complex partial seizures, 3.0% (1 case) had simple partial seizures, and 3.0% (1 case) suffered from status epilepticus.

Concerning the etiologic classification, 9 patients (27.3%) had idiopathic epilepsy syndrome while 8 patients (24.2%) had symptomatic, and 16 patients (48.5%) had cryptogenic epilepsy. Precipitating factors were found in 3 cases (9.1%). One patient suffered from sleeplessness. Two cases suffered from seizures within 1 h of awaken-

Discussion

This study, the first community-based study on epilepsy in Lao PDR, revealed a prevalence of active epilepsy among the population of 7.7 cases per thousand. Compared to Western countries, these results confirm the pattern towards a higher prevalence of epilepsy in tropical countries.

Our investigation employed a door-to-door screening approach by questionnaire with subsequent confirmation of suspected patients with epilepsy. This approach is promoted by the International League Against Epilepsy as a first choice for the community surveys in developing regions [13]. The sensitivity of the screening of our employed questionnaire is approximately 85–95% [4]. In order to improve case detection (sensitivity) we allowed self-reference of patients to a neurological examination. Indeed, a substantial number of additional patients with epilepsy could be identified.

Capture-recapture techniques, using three sources for case detection: door-to-door survey, a medical and a non-medical source, yield a significantly better prevalence [3]. Unfortunately, Lao health services at district level do not keep records of people with epilepsy. Hence, we were not able to add the third data source and to perform a capture-recapture analysis.

Our study benefited from an excellent population compliance. The survey team was very well received by virtually all households visited. In addition, almost all of the identified suspected people with epilepsy attended the
neurological confirmation visits (93.5%). In comparable studies, compliance has been a major drawback such as in a Hong Kong investigation where only a small portion (12%) of the suspected cases underwent a neurological examination [15].

The study was designed to provide the first prevalence data of Lao PDR as well as a further estimation for the subregion. To achieve this objective, sample size was defined to allow distinguishing a low prevalence typical of developed country (around 5‰) from a high prevalence typical of a developing country (around 15‰). Other research teams worked with similar precision [16–18].

The overall prevalence of 7.7‰ estimated in this study shows a pattern towards a higher prevalence compared to Western countries. However, it is low compared to other tropical countries in African or South America [2–4]. The estimated prevalence falls within the range of countries in the subregion (table 1) such as Thailand, China, Singapore and Hong Kong. In Nepal [12] and Vietnam, community investigations also showed prevalences of similar magnitude [Mental Health Institute, Ho Chi Minh City, 1992–1993, unpubl. data]. Indeed, a review by Jallon [19] brought out a difference between the average prevalence of Asia and Africa or Latin America for no obvious reason.

The relatively low prevalence calculated in this study is difficult to explain and could be due to several factors, in particular the absence of cysticercosis being an important cause of acquired epilepsy worldwide, especially in Africa [4, 20], South America [21–24] and India [25].

Data on cysticercosis are scarce in Lao PDR. Risk for cysticercosis, however, is high. *Taenia* spp. infections may be detected in up to 10% of the population in certain areas [Sayasone et al., pers. commun.] and cysticercosis is reported to be endemic in the region [26, 27]. Furthermore, pig-rearing is an increasing cash-generating activity of the Lao rural community, increasing high-risk behaviors such as close contact with pigs, uncontrolled defecation and the consumption of raw or undercooked pork, and also leads to other pig-related zoonoses such as trichinellosis [Sayasone et al., pers. commun]. Nevertheless, cysticercosis could be diagnosed in only 1 study patient and risk analysis did not identify this parasitic zoonosis as being a causal agent [Tran et al., pers. data]. Indeed, the proportions of raw or undercooked pork consumption and defecation elsewhere in patients were not different to those found in the explorative study in the general population (30 vs. 24% and 33 vs. 36%, respectively).

Another explanation could be a high mortality rate among patients with epilepsy. In our study area, 3 patients with epilepsy died between March 2004 and March 2005 (mortality rate 90.9‰ per year). Two drowned and the other died at home. Unfortunately, no further data are available in either the district/province or in the region to support this hypothesis. High mortality rates in patients with epilepsy have been reported from Cameroon (28.9‰) [28] and Ethiopia (31.6‰) [29] where patients mostly died from drowning, status epilepticus, sudden unexpected death and severe burn during epileptic attacks [28, 29].

Interestingly, the prevalence showed considerable variation between the villages which could indicate the presence of risk factors in a high prevalence village. However, environmental, sociological and economic conditions were very similar in all villages. Hence, we conclude that the variation was rather due to the relative low sample size of each village than any indication to prevalent risk factors.

The prevalence of active epilepsy was 4 times greater in the Lao Theung than in the Lao Loum. Most of the patients (90.9%) belonged to the Lao Theung, the ethnic group that makes up 71.8% of the population of these 8 villages screened in the Hinheub district. 9.1% of the epilepsy patients were Lao Loum who comprised 28.2% of the population.

Most of our patients were adolescents or young adults. Similar findings were reported from Latin American [2, 30]. De Bittencourt et al. [2] revealed that the peak prevalence in Latin American adults reflect remote symptomatic epilepsy related to specific risk factors such as infections (especially parasitic diseases) and trauma, either perinatal or lifelong, which are common in developing regions.

There is no significance in the proportion of clinical manifestations among our patients. Indeed, these distributions varied widely between studies [4]. The percentage of generalized tonic-clonic seizures in Lao patients was 63.6%, which is similar to results from studies in the diverse parts of Asia [31, 32]. For the etiologic classification, the distribution of symptomatic, idiopathic and cryptogenic epilepsy was 24.2, 27.3 and 48.5% respectively. The proportion found in the adult epilepsy patients in Hong Kong was 35.1, 5.0 and 59.9% [32]. Another result from Costa Rica was 25% symptomatic epilepsy, 48.3% idiopathic epilepsy and 26.7% cryptogenic epilepsy [33].

We noticed also that only 1 patient with epilepsy was currently under treatment. The treatment gap is a globally critical issue in developing countries [19, 34–37] and has been documented as well in the subregion such as in
China. In Lao PDR, antiepileptic drugs are limited in central hospitals and first-level pharmacies. These are, however, absent in rural areas where most pharmacies are of the third level [Odermatt et al., pers. commun.].

This is the first study to estimate the prevalence of epilepsy in Lao PDR. It was performed at the community level according to an internationally validated procedure. The study brings to light a relatively low prevalence of active epilepsy despite high risk factors for disease but shows a pattern towards higher prevalence compared to Western countries. This paradox needs further investigation to help build knowledge bases for community interventions.

Acknowledgements

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Appendix

Screening questionnaire [based on 14]

<table>
<thead>
<tr>
<th>Does the subject have a history of:</th>
<th>Yes = 1</th>
<th>No = 2</th>
<th>Unknown = 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Loss of consciousness and/or loss of bladder control and/or foam at the mouth?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>2 Absence(s) or sudden lapse(s) of consciousness during a short time?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>3 Involuntary clonic movements or muscular jerks of arm(s) and/or leg(s) (convulsions) that start suddenly and stop within minutes?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>4 Does the subject sometimes experience sudden and brief bodily sensations, see or hear things that are not there, or smell strange odors?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>5 Did someone tell the subject that he/she had epilepsy or that he/she already had epileptic fits?</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

References

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