Epilepsia, **46**(7):1127–1132, 2005
Blackwell Publishing, Inc.

Epilepsy and Neurocysticercosis in Rural Bolivia: A Population-based Survey

*Alessandra Nicoletti, †Alessandro Bartoloni, *Vito Sofia, †Filippo Bartalesi, ‡Josè Rosado Chavez, §Rimberto Osinaga, †Franco Paradisi, ‖Jean-Luc Dumas, ¶Victor C. W. Tsang, *Arturo Reggio, and **Andrew J. Hall

**Department of Neurosciences, University of Catania, Catania, and †Institute of Infectious Diseases University of Florence, Florence, Italy; ‡Health District of the Cordillera Province, Camiri, Bolivia; §Hospital San Juan De Dios, Santa Cruz, Bolivia; ‖Hopital Avicenne, University Paris, Paris, France; ¶Centers for Disease Control and Prevention, Atlanta, Georgia, U.S.A.; and **London School of Hygiene and Tropical Medicine, London, England*

Summary: *Purpose:* To evaluate the frequency of neurocysticercosis (NCC) in a well-defined prevalent cohort of epilepsy patients in the rural area of the Cordillera province.

Methods: We carried out a two-phase door-to-door neuroepidemiologic survey in a sample of 10,124 subjects in a rural area of the Cordillera Province, Bolivia, to detect the prevalence of the most common neurologic disorders including epilepsy. A team of health workers administered a standard screening instrument for neurologic diseases; subjects found positive at the screening phase underwent a complete neurologic examination. Epilepsy patients were diagnosed according to the definition proposed by the International League Against Epilepsy (ILAE, 1993). Epilepsy patients identified this way underwent electroencephalographic recording, computed tomography (CT) scan, and serologic evaluation to detect antibodies against *Taenia solium* by enzyme-linked immunoelectrotransfer blot.

Results: At the end of the survey, we detected 124 defined prevalent epilepsy patients. On the basis of the classification proposed by the ILAE in 1981, partial seizures were the most common type diagnosed (66 patients, 53.3%). Of the 124 patients, 105 underwent CT scan, and a serum sample was taken to detect antibodies against *T. solium* in 112 patients; for 97 patients, both neuroradiologic and serologic data were available. Considering radiologic, serologic, and clinical features, of these 124 patients, 34 (27.4%) fulfilled the diagnostic criteria for definitive or probable NCC proposed in 2001. Of these 34 patients 24 (70.6%) had partial seizures.

Conclusions: Our data confirm a high frequency of NCC among a well-defined prevalent cohort of epilepsy patients. **Key Words:** Neurocysticercosis—Epilepsy—Bolivia—Epidemiology.

Cysticercosis is a systemic infection by the larval tissue stage of the pork tapeworm *Taenia solium*. Humans acquire cysticercosis by ingesting eggs of *T. solium* in food or water contaminated by feces of individuals who harbor the adult parasite in the small intestine, or by autoinfection (1). Although cysticercosis has a worldwide distribution, its prevalence is highest in developing countries. Neurocysticercosis (NCC), caused by infection of the central nervous system with the larval stage of *T. solium*, is considered the major cause of neurologic disease in developing countries of Latin America, Africa, and Asia (2). NCC has a broad spectrum of clinical manifestations, with seizures being the most frequent, and is considered one reason for the higher incidence of epilepsy in developing versus industrialized countries (3).

Accepted March 5, 2005.
Address correspondence and reprint requests to Dr. A. Nicoletti at Department of Neurosciences, University of Catania, Via S. Sofia n° 78, 95125 Catania, Italy. E-mail: anicolt@unict.it

Even if NCC is a common disease, its diagnosis remains problematic. Neuroimaging studies are usually abnormal but not pathognomonic, and current serological assays to detect antibody against *T. solium* have shown decreased sensitivity in patients with single or calcified lesions. In particular, enzyme-linked immunoelectrotransfer blot (EITB), considered the most practical screening tool for epidemiologic research, has demonstrated a specificity of 100%, whereas the sensitivity is 90–100% for detection of cases with multiple intracranial cysticerci but has only 65% sensitivity in individuals with a single intracranial cyst (72% for an enhancing lesion and 40% for a calcified cyst) (4). For these reasons, combined neuroimaging and serologic evaluation are often necessary to reach a diagnosis. To determine the prevalence of NCC in populations and to compare epidemiologic surveys, a set of standardized international diagnostic criteria for NCC, based on a combination of clinical radiologic, serologic, and epidemiologic factors, was proposed in 2001 (5).

We carried out a two-phase door-to-door neuroepidemiologic survey to determine the prevalence of the most common neurologic disorders, including epilepsy, in rural Bolivia. This prevalence survey served as the framework for a case–control study to estimate the association between cysticercosis and epilepsy (6–8). Epilepsy patients identified during the survey were offered electroencephalographic recording (EEG), computed tomography (CT) scan, and serologic evaluation to detect antibodies against *T. solium* by EITB. Definitive or probable NCC was diagnosed according to the diagnostic criteria for NCC proposed in 2001 (5). The aim of the present work is to determine the prevalence of NCC in a well-defined population-based prevalent cohort of epilepsy patients. This survey represents the first population-based study entirely carried out in so large a rural population of a developing country in which both serologic and radiologic findings were used to determine the frequency of NCC among epilepsy patients according to a set of standardized diagnostic criteria.

The study was conducted with the agreement of the National Department of Epidemiology of the Ministry of Social Welfare and Public Health and with the support of the Guaraní political organization (Asamblea del Pueblo Guaraní, APG).

METHODS

Study population

The study was carried out in the rural area of the Cordillera province, Santa Cruz Department, in the southeastern part of Bolivia. The province covers 86,245 km^2 with a population of 88,628, of whom 55,675 live in rural areas. Ethnically the population is a mixture of Mestizos, descendants of intermarriage between Spanish colonists and the native tribes, and ~30% Guaraní Indians (9). Socioeconomic conditions in the rural areas are very poor (latrines are not always available; absence of running water; presence of animals around the households; low educational level, etc.). The health care infrastructure consists of a district hospital, nine area hospitals (often very far from the rural communities), and rural health centers. Neurologic departments and CT scan are not available in the Cordillera Province.

A random-cluster survey method was used, with each community constituting one cluster. Only communities with <2,000 inhabitants were selected to exclude urban areas. We selected a total of 10,124 people in 55 communities, of whom 9,955 were effectively screened in phase one (6). Age and sex distribution of the study population is shown in Table 1.

TABLE 1. *Age and sex distribution of the study population*

	Men		Women		Both sexes	
Age (yr)	No.	%	No.	%	No.	%
0–4	997	19.9	921	18.4	1,918	19.2
5–14	1,593	31.6	1,605	33.0	3,198	32.3
15–24	827	16.2	749	15.2	1,576	15.7
25–34	485	9.8	521	10.5	1,006	10.2
35–44	471	9.3	445	9.0	916	9.2
45–54	323	6.6	318	6.4	641	6.5
55–64	206	4.0	198	4.1	404	4.0
65+	133	2.5	163	3.3	296	2.9
TOTAL	5,035		4,920		9,955	

Case ascertainment

A preliminary door-to-door neuroepidemiologic study had been carried out to determine the prevalence of epilepsy on the prevalent day (PD) 1 Nov, 1994 (7). This was a two-phase study. In phase one, the sample of the rural communities selected from the 10 areas of the Cordillera Province was screened from door to door to identify persons who possibly had a disorder of neurologic interest. The interviewers who carried out the screening were local paramedical workers who had received prior training. In phase two, all subjects found positive on screening underwent a complete neurologic examination performed by neurologists (6,7).

We adopted the Sicilian Neuroepidemiologic Study (SNES) screening instrument (10), a slightly modified version of the WHO Neuroscience Research Protocol (11). We accepted the definition proposed by ILAE 1993: "Epileptic seizure is a clinical manifestation presumed to result from an abnormal and excessive discharge of a set of neurons in the brain"; "Epilepsy is a condition characterized by recurrent (two or more) epileptic seizures, unprovoked by any immediate identified cause. Multiple seizures occurring in a 24-h period are considered a single event. Individuals who have had only febrile or neonatal seizures are excluded from this category" (12). In an attempt to determine the accuracy of classification, patients with a clinical diagnosis of epilepsy underwent a standard electroencephalographic (EEG) recording. We performed all EEG recordings in the field by using 20-channel (portable) equipment. Electrodes were placed according to the international 10-20 system, by using referential and bipolar montages. Hyperventilation and intermittent photic stimulation were used routinely during EEG recording. We classified the EEG records as normal or with abnormalities consistent with generalized, focal, or multifocal epileptiform discharges. EEG records were analyzed independently by two observers. Seizure types were identified on the basis of the classification proposed by ILAE 1981 (7,13).

Serologic assay

Cases were assessed serologically for antibodies against *T. solium* by enzyme-linked immunoelectrotransfer blot (EITB). All samples were shipped on dry ice to the Centers for Disease Control and Prevention, Atlanta, Georgia

(CDC) for the enzyme-linked immunoelectrotransfer blot (EITB) (14,15). EITB diagnostic criteria for cysticercosis were the presence of antibody reaction to at least one of the seven *T. solium* glycoprotein antigens (15).

CT scan examination

CT scans were performed at the Hospital San Juan De Dios in Santa Cruz de la Sierra. Patients who underwent CT scan examination were taken from their community to Santa Cruz by car. We used a Toshiba model TCT-300s CT scan. Slices of 10 mm and 5 mm were performed for the study of the posterior fossa. For safety reasons, intravenous contrast administration was not performed.

Diagnostic criteria for NCC

Considering clinical, serologic, neuroradiologic, and epidemiologic data, NCC was diagnosed according to the diagnostic criteria proposed in 2001 (5). On the basis of these criteria, NCC was classified into definitive or probable NCC. To identify subretinal parasites, fundoscopic examination also was performed.

Ethical considerations

Informed consent was obtained from all adult participants and from parents or legal guardians of minors. The study design, including its ethical aspects, was reviewed and approved by the Bolivian Ministry of Social Welfare and Public Health and the local health authorities.

RESULTS

At the end of the two-phase door-to-door survey, we detected 124 prevalent epilepsy patients who fulfilled the ILAE diagnostic criteria, giving a prevalence of 12.3/1,000. Of the 124 defined patients, 89 (71.8%) had a standard interictal EEG recording. Thirty-five patients did not undergo EEG recording, and, in these patients, seizure classification is based only on clinical findings. On the basis of the electroclinical classification, 66 (53.2%) patients were classified as having partial seizures (56 with and 10 without secondary generalization), whereas 58 (46.8%) had generalized seizures. Detailed data on prevalence of epilepsy in rural Bolivia are extensively reported elsewhere (7).

Of these 124 defined epileptic cases, 105 (85%) underwent a cranial CT scan examination, of which 57 were normal; seven showed a single calcification; 11 showed multiple parenchymal round supratentorial calcifications; two single cystic lesion (not considered suggestive of NCC); 11 multiple cysticerci-related cystic lesions (highly suggestive for both size and localization); and 17 cases had other pathologies. According to the revised criteria for the diagnosis of NCC (5), none of these 17 patients had "lesions compatible with NCC" (hydrocephalus) classifiable as minor criteria. CT scan results are shown in Table 2.

Concerning the serologic tests, of the 124 prevalent patients, EITB to detect antibody against *T. solium* was performed on 112 patients, of whom a positive result was detected in 21 patients (18.6%); of these, 15 (74.6%) were affected by partial seizures.

TABLE 2. *CT scan evaluation according to the type of seizure*

CT scan	Partial seizures	Generalized seizures	Total
Normal	23 (39.7%)	34 (72.3%)	57 (54.3%)
Single calcification	6 (10.3%)	1 (2.1%)	7 (6.7%)
Multiple calcifications	9 (15.5%)	2 (4.3%)	11 (10.5%)
Single cyst	1 (1.7%)	1 (2.1%)	2 (1.9%)
Multiple cysts	8 (13.8%)	3 (6.4%)	11 (10.5%)
Other pathologies	11 (18.9%)	6 (12.7%)	17 (16.2%)
TOTAL	58	47	105

One hundred ten (88.7%) of the 124 epilepsy patients underwent a fundoscopic examination, but none of these patients showed evidence of parasites.

Epilepsy and neurocysticercosis

Definitive or probable NCC among this well-defined prevalent cohort of epilepsy patients was diagnosed according to diagnostic criteria proposed in 2001 (5). On the basis of these criteria, all 124 epilepsy patients had at least one epidemiologic and one minor criterion concerning the clinical manifestation. None of these patients fulfilled the absolute criteria.

Of the 124 prevalent epilepsy patients, 34 (27.4%), 21 men and 13 women, were affected by defined or probable NCC. In particular, 12 patients were classified as having definitive NCC, fulfilling at least two major criteria, one minor and one epidemiologic, whereas 22 patients were classified as probable NCC, fulfilling only one major criterion, one minor (in two cases, we found two minor criteria) and one epidemiologic; three patients with a positive EITB did not undergo a CT scan examination, whereas for two patients with multiple calcifications, the EITB was not performed. These patients were classified as probable NCC. These data are shown in Table 3.

Considering the type of seizure, of the 34 NCC patients, 24 (70.6%) were affected by partial seizures (21 with and three without secondary generalization), and only 10 (29.4%) by generalized seizures. Only two of these 10 patients with generalized seizures fulfilled the diagnostic criteria for definitive NCC. Thirty-two (94.1%) of these 34 patients were affected by active epilepsy. Concerning the age at onset for the 24 patients affected by partial seizures, the mean age at onset was 20 ± 16.1 (SD) years (median, 15), whereas for the 10 patients affected by generalized epilepsy, the mean age at onset was 7.9 ± 13.2 years (median, 3.5). Conversely, of the 90 prevalent patients not affected by NCC, 42 (46.7%) showed partial seizures with or without secondary generalization, and 38 (42.2%), generalized seizures.

TABLE 3. *NCC diagnostic criteria*

Patient no.	Age at PD (yr)	Age at onset (yr)	Sex	Type of seizure	EITB	CT scan (major)	Evidence	Major criteria	Minor criteria	Epid. criteria	NCC
1	27	15	F	PSGS	+	+	Multiple calcification	++	+	+	Definitive
2	15	10	F	PSGS	+	+	Multiple calcification	++	+	+	Definitive
3	56	55	M	PS	+	+	Multiple calcification	++	+	+	Definitive
4	18	12	M	GEN	+	+	Multiple calcification	++	+	+	Definitive
5	14	8	M	PSGS	−	+	Multiple calcification	+	+	+	Probable
6	5	0	M	PSGS	−	+	Multiple calcification	+	+	+	Probable
7	11	8	M	PS	−	+	Multiple calcification	+	+	+	Probable
8	13	11	M	PSGS	−	+	Multiple calcification	+	+	+	Probable
9	10	5	F	GEN	−	+	Multiple calcification	+	+	+	Probable
10	9	8	M	PSGS	Not performed	+	Multiple calcification	+	+	+	Probable
11	28	25	M	PSGS	Not performed	+	Multiple calcification	+	+	+	Probable
12	62	40	M	PSGS[b]	+	++	Multiple cysts[a]	+++	+	+	Definitive
13	11	8	M	GEN	−	++	Multiple cysts[a]	++	+	+	Definitive
14	26	16	F	PSGS	+	++	Multiple cysts[a]	+++	+	+	Definitive
15	80	68	M	PSGS	+	+	Multiple cysts	++	+	+	Definitive
16	40	22	F	PSGS	+	++	Multiple cysts[a]	+++	+	+	Definitive
17	40	32	M	PSGS[b]	−	++	Multiple cysts[a]*	++	+	+	Definitive
18	29	26	M	PSGS	+	+	Multiple cysts	++	+	+	Definitive
19	10	3	F	PSGS	−	++	Multiple cysts[a]	++	+	+	Definitive
20	4	4	F	GEN	−	+	Multiple cysts	+	+	+	Probable
21	1	1	F	GEN	−	+	Multiple cysts	+	+	+	Probable
22	10	9	M	PSGS	−	+	Multiple cysts	+	+	+	Probable
23	23	23	M	PSGS	+	−	Single calcification	+	+	+	Probable
24	16	12	M	PSGS	+	−	Single calcification	+	+	+	Probable
25	12	8	M	PSGS	+	−	Encephalocele	+	+	+	Probable
26	48	44	F	GEN	+	−	Negative	+	+	+	Probable
27	4	3	M	GEN	+	−	Arachnoid cyst	+	+	+	Probable
28	26	25	F	PSGS	+	−	Negative	+	+	+	Probable
29	33	26	F	PSGS	+	−	Corpus callosum agenesis	+	+	+	Probable
30	7	0	F	GEN	+	−	Not performed	+	+	+	Probable
31	3	1	M	GEN	+	−	Negative	+	+	+	Probable
32	3	1	F	GEN	+	−	Negative	+	+	+	Probable
33	23	21	M	PSGS	+	−	Not performed	+	+	+	Probable
34	16	10	M	PS	+	−	Not performed	+	+	+	Probable

PD, prevalence day; PS, partial seizures; PSGS, partial seizures with secondary generalization; GEN, generalized seizures.
[a]Presence of intracranial lesions in different evolutive stages (calcifications and cysts). This type of CT scan evidence has been considered as two major criteria (two different highly suggestive lesions).
[b]Not active.

When analysis was focused only on patients affected by late-onset seizures (20 years and older), 12 (31.6%) of 38 patients were classified as definite or probable NCC, whereas considering only the 26 patients affected by late-onset partial epilepsy, 11 (42.3%) were classified as definitive or probable NCC.

A slightly higher frequency of NCC was found when analysis was restricted to the 97 (78.2%) patients, for whom both serologic and radiologic data were available. In this group, 29 (30%) patients, 17 men and 12 women, fulfilled the diagnostic criteria for NCC (12 definitive and 17 probable) and, considering the type of seizure, of the 29 NCC patients, 20 (69.0%) were affected by partial seizures.

DISCUSSION

Epilepsy is considered an important health problem in developing countries, where prevalence ranges from 2.47/1,000 to 57/1,000 (16). The higher frequency of partial seizures in these countries compared with that in industrialized countries could be an indication of the high incidence of symptomatic epilepsy secondary to cortical damage (e.g., perinatal brain damage, head injury) (16). NCC has been reported as the most frequent parasitic infection of the central nervous system (CNS) and a major cause of epilepsy in several countries of Africa, Latin America, and Asia, even if few data have come from analytic epidemiologic studies (17–19). Until recently, studies of cysticercosis generally focused on clinical case series of patients with seizures or other neurologic symptoms. Studies based on hospital series have reported that $\leq$50% of epilepsy patients have cysticercosis as a putative factor (50% in the series studied in Mexico; 14% in the large series studied in Colombia; 12% in the series studied in Peru) (18–20). Epidemiologic reviews of cysticercosis are often biased by the lack of generalizability of such case series and by inappropriate comparisons between data from case series and data from community studies (4).

According to the literature, the lack of pathognomonic findings at neuroimaging studies and the low sensitivity

of current serologic assays in detecting antibodies against *T. solium* in patients with single or calcified lesions means that both serologic and radiologic findings are often necessary to achieve a correct diagnosis of NCC. In the adopted diagnostic criteria proposed in 2001 (5), both neuroradiologic (CT scan or MRI examination) and serologic evaluations play a central role in achieving a diagnosis of definitive or probable NCC. For these reasons, these criteria are rarely applicable in population-based studies and also in clinical practice for patients living in the rural endemic areas where these diagnostic procedures are generally not available.

Concerning Del Brutto's criteria, it is important to underline that some limits have been identified in their application, above all, for those that concern the positivity for antibody anti–*T. solium* detected in serum by the EITB assay. In particular, as seen in some published data, there is the possibility of some possible false-positive findings related to the presence of a single band at 50 kDa (21–23). Nevertheless, in epidemiologic surveys, the adoption of standardized diagnostic criteria is a critical issue to obtain comparable data, and, according to literature findings, the criteria selected in our survey are to date the most widely adopted.

The major strength of our study is related to its population-based nature that allowed us to establish the exact frequencies of NCC among a well-defined epilepsy population. We stress that much effort was used to obtain EEG, serologic, and neuroradiologic data in this population. To perform the CT scan examination, patients were taken to Santa Cruz de la Sierra, where CT scan was available. Often rural communities are very far from Santa Cruz city (sometimes several hours) and, furthermore, the conditions of the roads are very poor, especially during the rainy season.

According to the diagnostic criteria proposed in 2001 (5), we can conclude that in our epilepsy population, $\geq$27.4% of patients were affected by definitive or probable NCC (30% if we consider only those patients for whom both serologic and radiologic data were available).

We are aware that this percentage may be underestimated because of the lack of intravenous contrast administration, which can limit the interpretation of our results. In Latin-American countries, single enhancing CT scan lesions, considered as major criteria, are frequently seen and generally considered as cysticercus granuloma. In this case, plain CT scan may not reveal any abnormality (24).

It is important to stress that, of the 34 patients classified as having definitive or probable NCC, 24 (70.6%) were affected by partial epilepsy with or without secondary generalization; only 10 were classified as having generalized seizures. We can also conclude that >40% of late-onset partial epilepsy in our population might be related to NCC.

It is important to stress that the aim of this study was to evaluate the frequency of NCC in a well-defined population of epilepsy patients living in a rural area; the lack of CT scan data in a control group does not allow us to make any conclusion about association or causation.

Furthermore, we are aware that the use of a prevalent cohort of epilepsy patients does not allow us to be certain that exposure (*T. solium* infection) occurred before the outcome (epilepsy). On the basis of the present data, we also cannot exclude that the high frequency of NCC found in our population should be related to the higher frequency in the general population.

Our findings suggest that both serologic and radiologic evaluations are often necessary to make a definitive diagnosis of NCC. These diagnostic tools are unfortunately rarely available in endemic areas, and consequently, diagnostic criteria for NCC are rarely applicable. It is important to underline that a correct diagnosis of NCC is important not only for epidemiologic surveys, but also in clinical practice to evaluate the need for antiparasitic treatment (albendazole or praziquantel). From this point of view, according to our data, it is important to stress that NCC is more frequent among patients with partial seizures when these are correctly classified. The role of the EEG recording was important in achieving a more precise classification because of a better distinction between the partial seizures and the generalized ones, above all, when the partial onset is sudden followed by a secondary generalization.

Consequently in endemic areas, where serologic evaluation and CT scan are not easy to perform, a large effort should be made to achieve a correct classification of seizures, when possible, by using EEG data, and to reserve at least a serologic evaluation for patents affected by partial seizures. Even if implementation of neuroradiologic centers in rural endemic areas is hoped for, it does not seem realistic, so the availability of low-cost immunodiagnostic kits (ELISA, EITB, or others) in rural developing countries should be the first step to identify possible cases of NCC among selected epilepsy patients.

Cysticercosis is a preventable and treatable disease, and our results confirm that it could play an important role in the incidence of epilepsy in endemic areas of developing countries. Efforts should be made to develop appropriate control programs in these areas.

Acknowledgment: We thank Dr. Mario Lagrava, who was the Director of the Bolivian National Department of Epidemiology of the Ministry of Social Welfare and Public Health during the study period, and the Asamblea del Pueblo Guaraní for their encouragement and cooperation. We are also indebted to the field team members, Jorge Changaray (the health representative of the APG) and the 26 paramedical workers. We also thank Prof. Michel Dumas and Prof. Raul Di Perri for their useful collaboration as members of the adjudication panel.

This research was funded by a grant from the Italian National Research Council, CNR (PF FTMA 119.88).

REFERENCES

1. Del Brutto OH, Sotelo J. Neurocysticercosis: an update. *Rev Infect Dis* 1988;10:1075–87.
2. White AC. Neurocysticercosis: a major cause of neurological disease worldwide. *Clin Infect Dis* 1997;24:101–13.
3. Commission on Tropical Diseases of the International League Against Epilepsy. Relationship between epilepsy and tropical diseases. *Epilepsia* 1994;35:89–93.
4. Bern C, Garcia HH, Evans C, et al. Magnitude of the disease burden from neurocysticercosis in a developing country. *Clin Infect Dis* 1999;29:1203–9.
5. Del Brutto OH, Rajshekhar V, White AC, et al. Proposed diagnostic criteria for nerurocysticercosis. *Neurology* 2001;57:177–83.
6. Nicoletti A, Reggio A, Bartoloni A, et al. A neuro-epidemiological survey in rural Bolivia: background and methods. *Neuroepidemiology* 1998;17:273–80.
7. Nicoletti A, Reggio A, Bartoloni A, et al. Prevalence of epilepsy in rural Bolivia: a door-to-door survey. *Neurology* 1999;53:2064–9.
8. Nicoletti A, Bartoloni A, Reggio A, et al. Epilepsy, cysticercosis and toxocariasis: a population based case-control study in rural Bolivia. *Neurology* 2002;58:1256–61.
9. Bolivia, Instituto Nacional de Estadistica (INE). *Censo Nacional de población y vivienda*. La Paz: INE, 1992.
10. Meneghini F, Rocca WA, Grigoletto F, et al. Door-to-door prevalence survey of neurological diseases in a Sicilian population. *Neuroepidemiology* 1991;10:70–85.
11. World Health Organization. *Research protocol for measuring the prevalence of neurological disorders in developing countries. Neuroscience Programme*. Geneva: World Health Organization, 1981.
12. Commission on Epidemiology and Prognosis, International League Against Epilepsy. Guidelines for epidemiologic studies on epilepsy. *Epilepsia* 1993;34:592–6.
13. Commission on Classification and Terminology of the International League Against Epilepsy. Proposal for revised clinical and electroencephalographic classification of epileptic seizures. *Epilepsia* 1981;22:489–501.
14. Tsang VC, Brand JA, Boyer AE. An enzyme-linked immunoelectrotransfer blot assay and glycoprotein antigens for diagnosing human cysticercosis *(Taenia solium)*. *J Infect Dis* 1989;159:50–9.
15. Garcia HH, Martinez M, Gilman R, et al. Diagnosis of cysticercosis in endemic regions. *Lancet* 1991;338:549–51.
16. Senanayake N, Román GC. Epidemiology of epilepsy in developing countries. *Bull WHO* 1993;71:247–58.
17. Cruz ME, Schantz PM, Cruz I, et al. Epilepsy and neurocysticercosis in an Andean community. *Int J Epidemiol* 1999;28:799–803.
18. Garcia HH, Gilman R, Martinez M, et al. Cysticercosis as a major cause of epilepsy in Peru. *Lancet* 1993;341:197–200.
19. Medina MT, Rosas E, Rubio-Donnadieu F, et al. Neurocysticercosis as the main cause of late-onset epilepsy in Mexico. *Arch Intern Med* 1990;150:325–7.
20. Palacio GL, Jiménez I, Garcia H, et al. Neurocysticercosis in person with epilepsy in Medellín, Colombia. *Epilepsia* 1998;12:1334–9.
21. Garg RK. Proposed diagnostic criteria for neurocysticercosis. *Neurology* 2002;58:1315.
22. Katty MK. Proposed diagnostic criteria for neurocysticercosis. *Neurology* 2002;58:1315.
23. Kojic EM, White AC. A positive enzyme-linked immunoelectrotransfer blot assay result for a patient without evidence of cysticercosis. *Clin Infect Dis* 2003;36:e7–9.
24. Garg KR, Singh KM, Misra S. Single-enhancing CT lesions in Indian patients with seizures: a review. *Epilepsy Res* 2000;38:91–104.