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Clinical significance of neurocysticercosis in endemic villages

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Abstract

Cerebral cysticercosis is the main cause of late-onset epilepsy in most developing countries. Data on the neuroepidemiology of cysticercosis in endemic populations is scarce. In an endemic village on the northern coast of Peru, 49 individuals with neurological symptomatology (41 epileptic and 8 non-epileptic) were screened for antibodies to *Taenia solium*, using a serum electroimmunotransfer blot assay. Fifteen subjects were seropositive, 14 (34%) of those with epilepsy but only one (13%) of those who were non-epileptic. A history of passing proglottides was associated with positive serology. Thirteen of the 15 seropositive individuals underwent cerebral computed tomography; only 7 (54%) were abnormal. A randomly selected sample of 20 pigs from the village was also tested, and 6 (30%) were seropositive. This study demonstrated the importance of cysticercosis in the aetiology of epilepsy in endemic villages and the close relationship between porcine and human infection.

Keywords: cysticercosis, *Taenia solium*, epilepsy, Peru

Introduction

Hospital-based studies suggest that neurocysticercosis, infection of the human central nervous system by the larvae of the cestode *Taenia solium*, is the main cause of late-onset epilepsy in most developing countries, accounting for 20% to 50% of cases (MEDINA *et al.*, 1990; GARCÍA *et al.*, 1993). However, hospital populations are subject to multiple selection factors and may differ from the general population of endemic villages, where the real contribution of neurocysticercosis as a cause of epilepsy is still poorly defined.

Despite recent field-based serological studies in Peru (DIAZ *et al.*, 1992), Mexico (SARTI *et al.*, 1994; SCHANTZ *et al.*, 1994), and Ecuador (CRUZ *et al.*, 1994, 1995), data on the neuroepidemiology of cysticercosis are scarce. Antibodies to *T. solium* have been found in 29% of epileptic individuals in a field study in Mexico (SCHANTZ *et al.*, 1994), and abnormalities in computer tomography (CT) scans have been demonstrated in up to 70% of selected subgroups of seropositive individuals (CRUZ *et al.*, 1994; SCHANTZ *et al.*, 1994), but no systematic radiological examination has been done. This field study assessed the frequency of *T. solium* infection in the aetiology of epilepsy, and defined the radiological characteristics of cerebral infections in subjects who were not hospital patients.

Material and Methods

La Matanza, a village on the northern coast of Peru (population 5000), was selected because of accessibility and known *T. solium* endemicity. It has no paved street. Houses are built of *adobe*, with piped water. Approximately half of the houses have latrines. Domestic pig raising is extremely common, with usually 1–3 pigs roaming freely in and around the house.

One week before the survey, an information campaign was launched in co-operation with personnel from the local Health Centre, using house-to-house visits and public announcements over a loudspeaker system, offering medical attention to patients suffering from fainting or seizures.

Evaluation of patients included clinical history and examination, and a serum electroimmunotransfer blot (EITB) assay for antibodies to *T. solium*, performed as originally described by TSANG *et al.* (1989). Seropositive patients were offered cerebral axial CT scans in an urban hospital, which were performed in 10 mm sections, with and without intravenous contrast injection. Serology and CT scan results were given to the patients. All patients with epilepsy received adequate counselling and were prescribed anticonvulsants.

Blood samples (5 mL) from the vena cava were taken from 20 randomly selected pigs for EITB testing.

The study was approved by the ethical review boards of both the Universidad Peruana Cayetano Heredia and Johns Hopkins University.

Statistical analysis. Associations between categorical variables were tested by the χ^2 test or Fisher's exact test, and associations between continuous variables were tested by Student's t test or the Mann–Whitney test using SPSS™ statistical software (SPSS Inc., Chicago, Illinois, USA).

Results

Survey of humans

A total of 52 individuals came for evaluation, 3 of whom were excluded because they did not have neurological symptoms. Subjects were grouped into epileptics (n=41) and people with dizziness or headache (n=8). Most of the subjects were female. Their ages ranged from 6 to 87 years, with a mean of 27·5 (median 23, SD=19·9).

Fifteen individuals were seropositive. No difference was found between seropositive and seronegative individuals in sex or age.

Among epileptics, 14 (34%) gave a positive EITB result, in contrast to only one (13%) of the non-epileptic

Table. Prevalence of antibodies to *Taenia solium* in individuals with neurological symptoms in a rural village in Peru

	No. with positive electroimmunotransfer blot
Symptoms	
Seizures	14/41 (34·1%)
Headache or dizziness	1/8 (12·5%)
History of passing proglottides	11/23 (47·8%)

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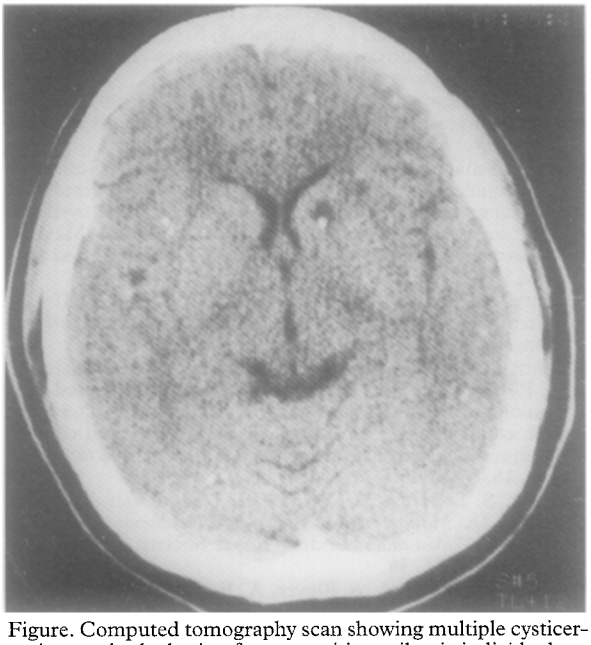

Figure. Computed tomography scan showing multiple cysticercosis cysts in the brain of a seropositive epileptic individual.

subjects (P=0·22). Individuals with positive and negative EITB results were similar with regard to age and sex. A history of passing proglottides was significantly more frequent in the seropositive group (P=0·03; Table).

The mean age at onset of seizures among the epileptic subjects was 11·5 years (median 10, SD=8·6), with no difference with respect to sex or EITB status. Seizures were partial in 16 cases (9 simple motor, 1 simple sensorial, 1 simple visual, 5 complex partial) and generalized in 25. A higher proportion of individuals with partial epilepsy was seropositive, although the difference was not statistically significant (8/16 versus 6/25; P=0·09).

Thirteen of the seropositive epileptic individuals had cerebral CT scans performed; 7 (54%) were abnormal and 6 were normal. Abnormal scans showed one active cyst (2 cases), multiple cysts (one case, Figure), 2 calcifications (2 cases), and multiple calcifications (2 cases).

Survey of pigs

Six of the 20 sampled pigs (30%) had antibodies to *T. solium* detected by EITB.

Discussion

Human cysticercosis is now recognized as a major cause of epilepsy in developing countries (COMMISSION, 1994). We have previously found, in a hospital-based serological survey, that 20% of epileptic patients coming from rural areas of Peru had antibodies to *T. solium* detected by immunoblotting (GARCIA *et al.*, 1993). The present non-random, community-based study found that 34% of epileptic patients in an endemic village were seropositive, as were 30% of a random sample of pigs, confirming the high prevalence of cysticercosis in epileptics and the close relationship between porcine and human infection.

The coexistence of neurological symptoms and positive serology strongly suggested cerebral infection in this population. However, only 7 (54%) of 13 seropositive individuals with epilepsy had abnormalities on CT, supporting our previous report that questioned the sensitivity of cerebral CT in demonstrating cysticercosis (GARCIA *et al.*, 1994). The cysts in most patients were calcified, and only one had an active infection with multiple intraparenchymal cysts. Patients with a normal CT scan may still have lesions, which may be found by the more sensitive technique of magnetic resonance imaging (MARTINEZ *et al.*, 1989). Alternatively, their cysticerci may have resolved without leaving residual calcifications in the brain. The EITB is highly specific (TSANG *et al.*, 1989; DIAZ *et al.*, 1992); thus it is improbable that the 6 patients with positive EITB results but negative CT scans had given false positive EITB results. Antibody memory may have contributed to the explanation of these cases, as successfully treated neurocysticercosis infections remain seropositive for *T. solium* antibodies for more than one year (H. H. Garcia, unpublished data).

Although the lack of a control group does not permit estimation of the baseline seroprevalence in La Matanza, the association between epilepsy and cysticercosis is emphasized by the fact that only one (13%) of a small group of 8 individuals with other neurological symptoms was seropositive, in comparison to a seroprevalence rate almost 3 times as high among epileptics.

Ascribing a definite number of epileptic cases to neurocysticercosis, based on the results of this study, was not possible. There were at least 2 potential sources of bias in the study. One was the possible inclusion in the seropositive group of carriers of adult *T. solium* and individuals with cysticercosis in places other than the nervous system, which would have overestimated the association between seropositivity and epilepsy. However, the presence of neurological symptoms supports the idea of cerebral involvement. The second source of bias was the possible exclusion of individuals with cysticercosis who were seronegative; persons with only a single lesion, or with calcified lesions, may be seronegative (WILSON *et al.*, 1991; CRUZ *et al.*, 1995). This would have resulted in underestimation of the degree of association.

The high proportion of patients with a history of passing proglottides in this population was surprising, and may have reflected a lack of specificity of the question asked ('have you ever passed white, flat, ribbon-like parasites or pieces of parasites with your stools?'). However, there was a significant association between such a history and a positive EITB result, suggesting that autoinfection may be important in the acquisition of neurocysticercosis in this population.

As with many infectious diseases, clinical cases of active neurocysticercosis seen in referral centres are probably a small selected subgroup of all infected individuals. Many other cases will not be diagnosed in endemic zones. The management of epilepsy in the field is difficult because of the scarcity and cost of anticonvulsants, in addition to sociocultural beliefs (SHORON *et al.*, 1991). Antiparasitic therapy may improve the course of epilepsy due to cysticercosis, although this is controversial (KRAMER, 1995). If its use is beneficial, in field conditions it may be a valuable addition to the management of infected individuals.

Current research in cysticercosis is centred on evaluating potential control measures (SARTI *et al.*, 1994; GONZALEZ *et al.*, 1996). Clinical cases of neurocysticercosis are not targeted because they do not contribute to perpetuation of the life cycle of the parasite (SCHANTZ *et al.*, 1993). On the other hand, villagers rarely recognize cysticercosis as a human health problem and may not be willing to co-operate with such programmes. Although not directly useful for purposes of control, a clinical/serological component may increase community co-operation in control programmes, a key element in their success.

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