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RESEARCH NOTE

Clinical, epidemiological and laboratory criteria for the diagnosis of human cysticercosis in Brazilian patients

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Abstract

Cysticercosis (CC) is a polymorphous disease, which makes its diagnosis difficult. This study had the objective of evaluating the clinical, epidemiological and laboratory criteria in human CC. An epidemiological questionnaire was applied, and indirect fluorescence antibody test (IFAT) and ELISA-IgG were utilized together with computerized tomography and/or magnetic resonance imaging on 90 patients with clinical signs suggestive of neurocysticercosis (NCC). Most patients had previously lived under deficient basic sanitary conditions. The imaging techniques showed that 92.2% of the cysticerci were in the cerebral parenchyma, 5.5% had a ventricular location, 1.1% were periventricular and 1% was ocular. The cysticerci were observed to be predominantly in the inactive phase. Seropositivity to the IFAT and/or ELISA was shown by 32.2% (29/90). Of the 29 seropositive patients, 72.4% presented cysticerci in the inactive form, and of the 61 seronegative patients, 78.7% also presented cysticerci in the inactive form. There was no correlation between active CC and seropositivity, since 72.4% of the seropositive patients presented calcified cysticerci. The results demonstrated that imaging techniques contributed significantly to elucidate the laboratorial diagnosis and to evaluate the stage of cysticercus development.

Key words

Cysticercosis, clinical examination, imaging, immunodiagnosis, epidemiology

Human cysticercosis results from the ingestion of the eggs of *Taenia solium*, and the taeniasis-cysticercosis complex represents a public health problem in African, Asian and Latin American countries (Garcia *et al*. 1999). After a migration phase the oncosphere, which hatches from the egg, becomes "installed" in various organs and transforms into cysticercus.

Neurocysticercosis (NCC) is the most serious form of the infection, and the severity of the disease depends on the numbers, localization and stages of development of cysticercus in the tissues (Barbosa *et al*. 1999, Carpio 2002, Lino-Júnior *et al*. 2002). Imaging techniques like computerized tomography scanning (CT scan) and magnetic resonance imaging (MRI) have improved the diagnosis of NCC, and have also allowed to define the number and topography of the lesions, a stage of cysticercus development and a degree of host inflammatory response against the parasite (Garcia and Del Brutto 2003).

Despite numerous advantages, the high cost of imaging techniques limits their use in several endemic regions. CT and MRI scans are highly suggestive of NCC, but in some cases the differential diagnosis with other infections or neoplastic diseases of the central nervous system may still be difficult. Therefore, immunodiagnosis, appropriate interpretation of the clinical symptoms and signs and also the epidemiological data cannot be neglected in suspected cases (Garcia and Del Brutto 2003). The immunological diagnosis itself, despite the availability of various tests, is still very controversial regarding its sensitivity and specificity.

Considering all these difficulties an evaluation of the clinical, epidemiological, imaging and serological criteria in a group of patients with symptoms suggestive of NCC was performed.

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The participants included in the study were 90 patients, who attended the Reference Center for Epilepsy Treatment and Research (CERTEPE) in Clinical Hospital, Federal University of Goiás, between January 2001 and March 2002. Informed consent forms were signed by all study participants. The patients came from the States of Goiás, Rondônia, Bahia, Tocantins and Mato Grosso.

An epidemiological questionnaire was applied, and indirect fluorescence antibody test (IFAT) and ELISA-IgG were utilized together with CT and/or MRI scans on patients. The data were entered into a structured database using Epi Info 6.0 program. Frequency tables and cross-referenced tabulation were obtained and the χ^2 test was used for identification of the differences between proportions. Probability values $p<0.05$ were considered to be statistically significant.

Convulsions, headache, dizziness and motor, sensory, visual and psychiatric symptoms and signs were common clinical conditions presented by the studied patients. The most frequent forms were convulsive crises as the only symptom (35.5%, 32/90); convulsive crises in association with headache (28.9%, 26/90); and mixed forms for the clinical manifestation of NCC (convulsive crises and motor, sensory and visual alterations; headache and motor alterations; headache and visual alterations; convulsive crises and sensory alterations) (35.5%, 32/90).

Deficiencies in the sewage network (88%, 79/90), utilization of unfiltered water (95.5%, 86/90) and ingestion of raw or badly cooked pig meat (84.5%, 86/90) were major risk factors.

The imaging examinations showed that 92.2% (83/90) of the patients presented parenchymal cysts; 5.5% (5/90) ventricular cysts; 1.1% (01/90) periventricular cysts and 1.1% (01/90) ocular cysts. Majority of the patients (75.5%; 68/90) presented the metacestode forms of *T. solium* in the inactive form only.

The serological tests showed positivity of 32.2% (29/90) and negativity of 67.8% (61/90) in ELISA and in indirect immunofluorescence. It was seen that, of the 29 seropositive patients, 72.4% presented cysts in the inactive form and, of the 61 seronegative patients, 78.7% also presented cysts in the inactive form. Thus, there was no difference between the two groups (Table I) ($\chi^2 = 1.67$; $p>0.05$). There were similar results for both the patients with active and degenerating cysts and those with mixed forms, i.e. those with active, inactive and degenerating cysts.

Criteria for the diagnosis of NCC, based on clinical, epidemiological, immunological and imaging data have been proposed by Del Brutto *et al*. (1996, 2001). Once such data are available, a preliminary diagnostic stage can be made with the following four grades of criteria: absolute, major, minor and epidemiological. The interpretation of these four criteria would allow two degrees of diagnosis to be established, namely a definitive or probable. A definitive diagnosis can be concluded in patients, who have one absolute criterion or those who have major plus one minor and one epidemiological criteria; and a probable diagnosis, in patients who have one major plus two minor criteria, as well as in those who have one major plus one minor and one epidemiological criteria, and in those who have three minor plus one epidemiological criteria. Dorny *et al*. (2003) corroborated the observations by Del Brutto *et al*. (2001) with the suggestion that the criteria utilized for the diagnosis of NCC should be based on imaging data combined with clinical, serological and epidemiological characteristics.

From a clinical viewpoint, NCC is considered to be an important cause of convulsions among children; in endemic regions, the most important cause of epilepsy after the age of 25. The utilization of imaging techniques has demonstrated that 50–70% of patients with neurocysticercosis present convulsions (Roman 2003). In the present study, 35.5% of the patients had convulsive crises as the only symptom and 28.9% presented convulsive crises in association with headache. Headache of nonspecific character, that began recently (<1 year) without any apparent cause, may appear as the only manifestation of the disease. Cranial hypertension syndrome (oedema of the optic papilla, headache and vomiting), psychiatric disturbances, meningeal syndrome, paralysis of cranial pairs and medullary compression syndrome are all possible forms for the clinical manifestation of NCC (Arruda 1991). A diagnosis of suspected NCC is raised in all patients in the present study as the symptoms were suggestive but not specific for NCC.

Maretti (1999) found positive values of 37.7 and 31% in ELISA and IFAT, respectively, in CSF samples from 177 pa-

Table I. Serology by IFAT and/or ELISA-IgG tests and developmental stages of metacestode forms of *Taenia solium* in 90 patients with clinical signs of neurocysticercosis diagnosed by computerized tomography scan and/or magnetic resonance imaging

Diagnosis by CT* scan and/or MRI**	Serology				Total	
	positive	%	negative	%	n	%
Active and degenerating cysticerci	5	17.2	5	8.2	10	11.1
Inactive cysticerci	21	72.4	48	78.7	69	76.6
Active, degenerating and inactive cysticerci	3	10.3	8	13.1	11	12.2
Total	29	100	61	100	90	100

*CT – computerized tomography scan; **MRI – magnetic resonance imaging; $\chi^2 = 1.67$, $p>0.05$.

tients with NCC. The percentage of seropositive results, found by using ELISA and IFAT in the present study is equivalent to those described by Maretti (1999). Among the patients found to be seronegative by ELISA and IFAT, 78.7% presented inactive calcified cysticerci. However, among the seropositive patients, 72.4% also presented calcified cysticerci. There was no correlation between being seropositive and having active CC and in this respect the results from the present study coincide with the reports by Garcia *et al*. (1994) and Sánchez *et al*. (1997). It is still not known how long the antibodies persist in patients, whose cysticerci have already become calcified. Seronegative patients with calcified cysticerci may have had active CC in the past and a reduction in immune response may have taken place (Garcia *et al*. 1999).

The physician needs to know a number, location, size, and stage of intracranial parasites, but serology mostly has a screening or confirmatory role and should be used in conjunction with neuroimaging (Garcia *et al*. 2003). In the present study, imaging techniques demonstrated to be of high sensitivity for NCC diagnosis and, as opposed the serological tests, allowed the stage evaluation of cysticercus development.

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