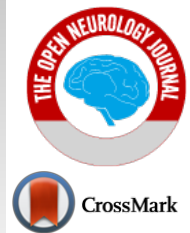


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RESEARCH ARTICLE

Inactive Calcified Cysts In Neurocysticercosis: Is This Actually The Case?

José Augusto Camargo^{1,*} and Reinaldo José Gianini²

¹Neuroscience Research Institute Newclin . Sorocaba, São Paulo, Brazil

²Faculdade de Medicina, Pontificia Universidade Católica de São Paulo, São Paulo, Brazil

Abstract: Neurocysticercosis is a worldwide disease that is extensively neglected. Its real gravity is not disclosed to people. Knowledge for the population in all countries must be done urgently.

Keywords: Neurocysticercosis, Inactive Calcified Cysts, Seizures, Human Neuroinfection, Neglected disease, Global disease.

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Neurocysticercosis (NCC) is a term used to define the involvement of the central nervous system (CNS) by the larval form of *Taenia solium*. Neurocysticercosis is a leading cause of adult-onset seizures in the world and one of the most common parasitic infections associated with chronic morbidity in the United States. Despite the importance of this infection, the morbidity caused by NCC worldwide is undervalued and its research is underfunded. As a consequence, researchers are unable to obtain updates on recent advances that hold great promise to prevent millions of cases of epilepsy and to effectively treat brain infections.

In view of the increasing globalization, food-borne parasitic infections are becoming more prevalent around the world, even in countries where these parasites and parasitic diseases had already been well-controlled or eradicated. Improved sanitation, health education and the establishment of adequate food safety mechanisms can go a long way towards the control of many of these infections. However, food-borne parasitic infections continue to be common diseases in developing countries, especially in rural areas. Since many of today's travelers are looking to explore further afield and to experience different cuisines, they may be at greater risk of acquiring a food-borne parasitic infection, including those caused by a wide range of adult worms and larvae [1].

According to a joint report of the Food and Agriculture Organization and WHO, helminth infections are research priorities of the United Nations and NCC is the main preventable cause of epilepsy, with an estimated 2 million people having epilepsy in the developing world. Neurocysticercosis is

caused by the pork tapeworm, *Taenia solium*, which belongs to cyclophyllid cestodes in the family Taeniidae. The larval or cysticercus stage of this zoonotic intestinal parasite can infect both humans and pigs, and if the infection reaches the brain, it can cause a variety of debilitating neurological problems [2]. Despite the enormous social costs and overall effects associated with NCC, about 50 million people in the world have the infection and 50-70% of all individuals with symptomatic cysticercosis have seizures. Information about the origin of these parasites, how they live in the human body and, most importantly, how they cause diseases is generally sparse. The paucity of diagnostic methods and the lack of consistent intervention studies as part of integrated helminth control strategies mean this infection is still neglected, even in countries such as the United States [2, 3, 7]. The disease is most commonly reported in members of agricultural societies with poor sanitary conditions and economies based on pig farming with poor hygiene standards. However, the disease has been increasingly reported in developed countries because of immigration from endemic countries [3, 4].

Neurocysticercosis is a fairly common disease, with up to 5,000 new cases being reported in the United States every year. New late-onset neurological symptoms in patients with a history of NCC should lead the physician to suspect recurrent NCC as a potential etiology, since a considerable number of patients suffer from late neurological sequelae [5 - 9]. According to Garcia et al 2010 [10], the observation of seizures should be the ultimate objective of any type of intervention in the treatment of NCC. Decreased numbers of seizures would mean better quality of life for affected patients. The efficacy of antiepileptic drugs in treating or reducing the occurrence of subsequent seizures secondary to parenchymal NCC is also unclear [9]. Public health efforts in conjunction with global

* Address correspondence to this author at the José Augusto Camargo, Av Juscelino Kubitschek de Oliveira 753 / sala 11, 18035-060 Sorocaba SP – Brasil; E-mail: jacneuro@hotmail.com

collaborations will be of fundamental importance to provide better diagnostic methods and therapeutic interventions in order to eradicate this neuroinfection [2, 4, 9]. In addition to seizures, the clinical features of NCC also include dementia which could be a confounding factor for clinicians with few resources who go as far as to treat the patient as an epileptic or as a psychiatric case. Seizures appear in adulthood even in the absence of a family or personal history and can be associated or not with late loss of consciousness. These seizures can involve and cause headache of poorly specific evolution, vomiting, visual disturbances, sudden mental disorders associated with seizures and headache, and poorly systematized mental symptoms, both in their vesicular and calcified form [10, 11].

There are numerous classifications of NCC which vary according to topographic, clinical and laboratory criteria. The advent of computed tomography (CT) and the correlation of its findings with clinical and cerebrospinal fluid features permitted the elaboration of a new classification proposed by Sotelo et al. 1985 [12] according to the vitality of cysticerci into active and inactive forms.

New studies on the topic suggest reflection about the term “inactive cyst” proposed by Sotelo et al. 1985) and Carpio et al. 1994 [12 - 16]. All too often do we observe that medical and healthcare professionals, who are unfamiliar with the disease, are left with the false notion of an already resolved, harmless or cured disease that does not result in further damage when they are faced with reports or imaging test results (CT and magnetic resonance) stating the term inactive cyst or cerebral calcification. In many cases, patients are diagnosed as having cerebral calcifications by X-ray or cranial CT performed in situations of trauma and these images are considered a “finding” without clinical value for the professional [14]. We observe that this thinking is disseminated by healthcare professionals in a disturbing manner across the world and consequently accepted by the general public. However, as reported in different studies, even if calcified, the cyst can cause local reactions in the host [3, 4, 6, 11, 14 - 17].

We understand that our role as researchers is to guide the population about the risks of this pathology when present in the form of calcification. We cannot forget that many researchers with intense research work are concerned with the worldwide neglect of the disease. Millions of dollars are spent on the treatment of cysticercosis in its cystic form worldwide, often with hospital admissions and surgical treatments. There are no precise studies on the worldwide number of patients being treated for symptoms resulting from calcified neurocysticercosis, however, changes in the cerebral parenchyma have been demonstrated. With the knowledge of the world population that Neurocysticercosis is a chronic disease, we will be contributing to a greater awareness of the importance of its prevention.

Within this context, we consider it to be adequate to replace the term “inactive cyst” with “inactive reactive cyst” or “calcification” with “reactive calcification”, explaining to all that, even when calcified, the cyst causes reactions in the host tissue that can lead to damage, or at least that we are talking about a severe disease. Only with the awareness of healthcare

professionals and of the general public about the importance of this disease, which is considered eradicable. Camargo, J.A et al. [14, 15], will one day be able to get rid off its ailments.

Everything leads us to believe that NCC is able to promote changes in the brain parenchyma which reacts to the “foreign body”, causing life-long symptoms. However, the underlying mechanisms need to be better understood so that the progression and dissemination of the disease can be prevented. Whether or not this hypothesis is true, there is global consensus that this disease is undervalued by healthcare professionals [18 - 24].

Something needs to be done!

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