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ANATOMOPATHOLOGIC FINDINGS IN CARDIAC CYSTICERCOSIS: A POSTMORTEM STUDY

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ABSTRACT

Cysticercosis is a parasitic disease produced by the larval stage of the *Taenia solium* and the heart is one of the sites of infection. In spite of the fact that neurocysticercosis is well described in the literature, there are few reports on cardiac cysticercosis what justifies the performance of this study. *Objective:* the present study aimed at the dynamic evaluation of the host-parasite relationship in cardiac cysticercosis in autopsy material. *Materials and Methods:* Records of autopsies performed at the Federal University of the Triangulo Mineiro Hospital, Uberaba, Brazil, from 1970 to 2005, were reviewed. From the selected cases, a morphological analysis was performed to identify the general pathological processes. *Results:* The occurrence of cysticercosis was verified in 71(3.2%) cases. Despite encephalic occurrence being the most frequent (74.6%), cardiac localization (25.4%) was the second most encountered in our material, mainly in non-Caucasian individuals (72.3%). Several pathological processes were found, such as glycogen deposits, amyloidosis, fibrosis and fibroelastosis that showed association with cardiac cysticercosis. *Conclusion:* These data contribute to the knowledge of cardiac cysticercosis pathology and its possible anatomo-clinical correlations.

KEY WORDS: Autopsy. Cysticercosis. Heart. Morphology. Pathology.

INTRODUCTION

Taeniasis and cysticercosis are diseases produced by the adult and larval stages from helminths of the Taenidae family, respectively. Humans are the

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definitive hosts for the adult stage of both *Taenia* species, *T. solium* and *T. saginata*, while pigs and cattle are the intermediate hosts, respectively, for the larval stages of these parasites (5, 7).

Epidemiological data referring to cardiac or heart cysticercosis (HC) are few in the literature and are restricted only to case reports (9, 15, 13). However, reports on neurocysticercosis indicate the high prevalence of this disease in some regions of Brazil (1). In Ribeirão Preto, a city in São Paulo State, cysticercosis is a disease of compulsory notification. The incidence of neurocysticercosis in this city comes from clinical and autopsies data and the prevalence coefficient is of 67 cases/100.000 inhabitants (3).

Several autopsy reports contributed to the epidemiological knowledge of cysticercosis in Latin America, especially in Brazil, Colombia, Mexico, Peru and Guatemala. Moreover epidemiological studies added to serological tests provide a more accurate knowledge about this helminthic disease (6, 18).

When examining cysticerci under the microscope, three different zones were considered: 1) parasite; 2) host-parasite interface and 3) host tissue (17). In the heart, cysticerci may reach all layers from the epicardium and myocardium to the endocardium (9, 10, 12). Lesions in HC are described as endocardial fibroelastosis, myocarditis, restrictive cardiomyopathy and congestive heart failure (9, 13). However, there is no description of the zones associated to the general pathologic processes in HC in the literature. Moreover, the description of the lesions found can contribute to the evidence of possible clinical manifestations seen in these patients. The aim of the present study was to describe the dynamics of the host-parasite relationship in cardiac cysticercosis in autopsy material.

MATERIALS AND METHODS

General Characterization of the Sample

We reviewed 2.218 autopsies performed between 1970 and 2005 in the Hospital of the Federal University of the Triangulo Mineiro, Uberaba, Minas Gerais, Brazil. Age, ethnic group (Caucasian and non-Caucasian), gender and site of cysticerci in the heart are reported. The general pathological processes (GPP) investigated were: cell pathology; pathology of the interstitium; local alterations in blood circulation; pathological pigmentations; pathological calcification; edema; inflammatory processes; and disturbances in growth and cell differentiation. The present study was approved by the Ethics Research Committee from the Federal University of the Triangulo Mineiro.

Morphological Analysis

A macroscopic evaluation of the number of cysticerci, their implantation sites in each region of the heart and the GPP were made. For the microscopic

analysis, heart fragments with cysticerci were submitted to routine processing to obtain 6μm sections stained with hematoxylin-eosin technique or other histochemical techniques when necessary, such as picro-sirius, for identification of fibrosis; periodic acid Schiff, for glycogen deposits; von Kossa, for calcium salts deposits; Congo red, for beta-fibrilosis (amyloidosis); Giemsa; and Weigert-van Gieson, for elastic fibers. Microscopic lesions were classified in a semi-quantitative manner, according to the following criteria: absent; discreet with up to 25% of compromised area; moderate from 26 to 50% of compromised area and severe, above 50% of compromised area.

Statistical Analyses

For statistical analysis the software SigmaStat *2.03* was used. In cases with normal distribution, the "t" Student test was used to compare two groups. In cases where the distribution was not normal, the Mann-Whitney test was used. The proportions were compared by the χ^2 test, or the Fisher Exact test. P values under 0.05 were considered statistically significant.

RESULTS

General Characteristics of the Sample

Cysticercosis was found in 71 of 2.218 autopsy protocols (3.2%), 18 of the 71 cases (25.3%) presented cardiac localization, and 74.7% were neurocysticercosis. Among the individuals that did not have cysticercosis, the median age was 48, varying from 15 to 99 years old. Among the individuals with cardiac cysticercosis, the median age was 44 years, varying from 36 to 86 years old. From the individuals with cardiac cysticercosis, 13 (72.2%) were male. The non-Caucasian individuals had a significantly higher incidence of HC when compared with Caucasian (27.8%) (χ^2= 5.659; p=0.017).

Morphological Analysis

For macroscopic analysis 8 hearts were selected containing in total 29 cysticerci which were found in the following localizations: subepicardium, 11 (37.9%); intra myocardium, 6 (20.7%); and subendocardium, 12 (41.4%). The highest number of cysticerci encountered in a single heart was 9. For microscopic analysis 8 hearts were selected containing 10 oval cysticerci which had viable parasites with fluid-filled vesicles with an invaginated scolex, external membrane covered by microvilli and internally the spiral canal. There were no statistically significant differences in the GPP and the localization of cysticerci in the heart (table 1). Macroscopic and microscopic aspects of cysticerci are presented in figures 1 to 4.

Table 1. Distribution of general pathological processes (GPP) found in 10 cases of cardiac cysticercosis from autopsied individuals accordingly to the committed zone.

GPP	Zones								
	Parasite			Interface			Host		
	n			n			n		
	SEp	IM	SEn	SEp	IM	SEn	SEp	IM	SEn
Degeneration/Cellular death	-	1	-	-	-	2	7	6	2
Glycidic radicals deposits	4	-	1	2	4	2	1	-	-
β-fibrilosis	1	-	-	4	3	2	1	-	-
Fibrosis and or fibroelastosis	2	-	1	4	4	2	6	4	2
Calcification	-	-	-	1	1	-	-	-	-
Lipofuscin	-	-	-	-	-	-	4	1	2
Inflammation	1	1	-	4	4	2	4	2	1
Vascular proliferation	-	-	-	4	4	2	3	3	2

Legend: Sep: sub-epicardiac, IM: intra-myocardiac, Sen: sub-endocardiac, GPP: General Pathologic Processes, n= number of cases. Obs: The sum surpasses 100%, because some cases presented the pathological processes in more than one location.

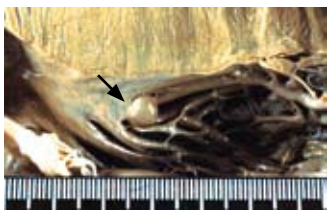

Figure 1: One cysticercus in the sub-endocardiac localization (arrow).

Figure 2: Cysticercus in the intramyocardiac localization of the interventricular septum (arrow).

Macroscopically, cysticerci of subepicardiac and intramyocardiac localizations looked viable with focal epicarditis in the former and in anatomical projection of the His bundle system, in the latter (figure 2). Cysticerci in subendocardiac localization were destroyed and endocardiac fibroelastosis was seen (figure 1).

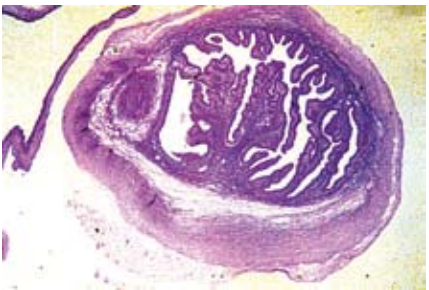

Figure 3. Microscopic image of a preserved cysticercus (Schiff periodic acid, 50x).

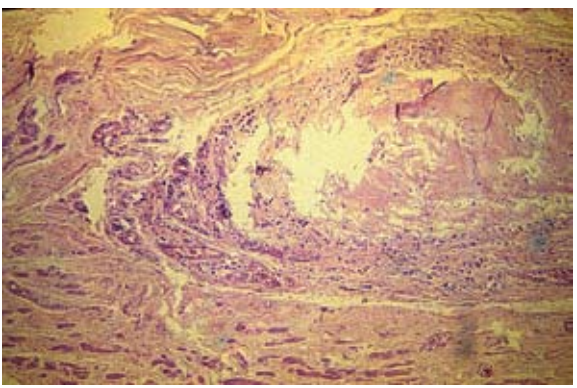

Figure 4. Microscopic image of a cysticercus in the subepicardiac localization. Fibrosis is observed in the parasite, in the host-parasite interface and in the tissues of the host (Hematoxilin-eosin, 125x).

Microscopically the cysticerci were identified as:

1) Preserved: a) in the parasite with severe intensity: glycogen deposits (figure 3) and with discrete intensity: fibrosis; b) in the host-parasite interface discrete alterations were observed of: glycogen deposits, beta-fibrilosis (amyloidosis), mononuclear inflammatory infiltrated, fibrosis, vascular proliferation, vasculitis, congestion and calcification; c) in the tissue of the host discrete alterations were observed of: mononuclear inflammatory infiltrated,

fibrosis, hydropic degeneration, vasculitis, vascular proliferation, congestion, hypotrophy, hydropic and hyaline degeneration and edema.

2) In destruction: a) in the parasite, with mild intensity: glycogen deposits and beta-fibrilosis (amyloidosis), and with severe intensity: mononuclear inflammatory infiltrated; b) in the host-parasite interface with discrete intensity was observed vasculitis and calcification; with mild intensity were observed: glycidic radicals deposits, beta-fibrilosis (amyloidosis) and vascular proliferation; and with severe intensity were observed mononuclear inflammation infiltrated, congestion and fibrosis; c) in the tissue of the host with discrete intensity were observed fibroelatosis, vasculitis, glycidic radicals deposits and hydropic and hyaline degeneration; with mild intensity were observed beta-fibrilosis, edema and congestion; and with severe intensity were observed mononuclear inflammation infiltrated, vascular proliferation and fibrosis (figure 4).
3) Destroyed: a) in the parasite was observed the glycidic radicals deposits and mononuclear inflammatory infiltrated with discrete intensity and fibrosis and necrosis with severe intensity; b) in the host-parasite interface with discrete intensity were observed: glycidic radicals deposits, vasculitis, congestion, hydropic and hyaline degenerations; with mild intensity: beta-fibrilosis, fibroelastosis and vascular proliferation; and with severe intensity the mononuclear inflammatory infiltrated; c) in the host tissue with discrete intensity were observed: vasculitis, fibroelastosis, necrosis, congestion, edema and hydropic and hyaline degeneration; with mild intensity the vascular proliferation and fibroelastosis and with severe intensity the mononuclear inflammatory infiltrated.

DISCUSSION

Cardiac cysticercosis was found in 0.8% autopsies performed between 1970 and 2005, giving in average of 0,02% per year as compared to 8% found by Vianna et al (18) who examined 64,991 anatomic and pathologic analysis from hospitals in Brasilia, Brazil, from 1967 to 1984. The median age of individuals with HC in our material was 44 years old which is a higher age bracket than the one described in a previous study, which was from 21 to 40 years old, from review articles on cysticercosis on several localities (1). Maybe this difference is due to the fact that this author had studied clinical and autopsies data altogether.

Usually, Caucasians have prevailed over non-caucasians among findings of cysticercosis in autopsies from various tissues in studies performed in Brazil (10). However, in the present study, non-Caucasians had significantly more cardiac cysticercosis than Caucasians. We suggest that this fact may be due to the linked genotype peculiarities, similar to those observed in other diseases (2, 14, 16).

In this study, cysticerci were found in all layers of the heart and the most frequent localization was subendocardiac in which endocardiac fibroelastosis was present. In spite of the inflammatory reaction around cysticerci, the lesions

vary according to the implantation site. The lesions found in HC do not appear to depend on the implantation site of the cysticercus, except for endocardiac ones, where the fibroelastosis prevailed. Therefore, despite HC is generally considered asymptomatic (9), it may cause functional lesions, especially in its intramyocardial form (8, 13). In the present study, this localization was found in 20.7% of the cases, with inflammation in 100% of the cysticerci studied under the microscope, 25% of the 20.7% were destroyed, and in one of the hearts nine cysticerci were found. It is probable that in the myocardium, similar to what is seen in the central nervous system, inflammation and vascular lesions may, in addition to the mechanical action, produce irritability phenomena in the ordinary myocardium or alterations in the intraventricular conduction pathways (8, 11), myocardial infarction or blockage (9). It should be noted that in one of the few cases of cardiac cysticercosis described in the literature, diagnosis of cysticercosis was made *in vivo* via computerized tomography, indicated because of a myocardial infarction of the patient (4). In another report, the authors suggest that cardiac arrhythmia due to cardiac commitment in cysticercosis could be the cause of sudden death (15).

All the GPP that we described in HC in the present study could be identified, as we systematically used specific staining techniques. We suggest that these complementary data contribute towards a better understanding of the host-parasite interaction, emphasizing the description of fibrosis and beta-fibrilloses. Considering the analyzed data, we verified that the occurrence of cardiac cysticercosis was frequently the second most found, attacking mainly non-Caucasian individuals. Amongst the several pathological processes described in this study, the most important finding was the endocardial fibroelastosis reported surrounding cysticerci.

RESUMO

Achados anatomopatológicos na cisticercose cardíaca: estudo postmortem

A cisticercose é uma doença produzida pelo estágio larval de *Taenia solium* e uma de suas localizações é o coração. Apesar de a neurocisticercose ser bem descrita na literatura, existem poucos relatos a respeito da cisticercose cardíaca, o que justifica este trabalho. *Objetivos*: O presente estudo tem como objetivo avaliar, em autópsias, a dinâmica da relação parasito-hospedeiro na cisticercose cardíaca. *Materiais e Métodos*: Foram analisados protocolos de autópsias realizadas no período de 1970 a 2005 no hospital da Universidade Federal do Triângulo Mineiro, Uberaba (MG), Brasil. Realizou-se a análise morfológica dos casos selecionados para identificação dos processos patológicos gerais. *Resultados*: Foi verificada a ocorrência de cisticercose em 71 (3,2%) dos casos. Embora a localização encefálica tenha sido a mais freqüente (74,6%), a cardíaca (25,4%) foi a segunda mais encontrada no material analisado, com predominância significativa nos indivíduos não-caucasianos (72,3%). Vários processos patológicos gerais foram

encontrados: depósito de radicais glicídicos, amiloidose, fibrose e fibroelastose em associação com a cisticercose cardíaca. *Conclusão*: Esses dados contribuem para o conhecimento da cisticercose cardíaca e suas possíveis correlações clínicas.

DESCRITORES: Autópsia. Cisticercose. Coração. Morfologia. Patologia.

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