A RARE CASE OF FAMILIAL ECHINOCOCCOSIS AFFECTING ALL FAMILY MEMBERS: CASE REPORTS AND REVIEW OF LITERATURE

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ABSTRACT

Echinococcosis is a parasitic disease that affects humans, caused by the larval stage of the *Echinococcus* tapeworm. The disease is a major health problem in many parts of the world, including Bulgaria. It has a long incubation period and can affect various organs, but most commonly the liver and lungs. In this article, we present cases of echinococcosis diagnosed in all members of the same family, highlighting the importance of early diagnosis and the need for effective prophylactic measures. Regardless of the degree of endemicity, cases of familial echinococcosis are rare in medical practice. Therefore, a comprehensive epidemiological study is needed to establish the causes of such a phenomenon. In conclusion, seroepidemiological research on echinococcosis and imaging (ultrasound and X-ray) of seropositive individuals should be performed among risk groups to establish hidden morbidity, particularly among communities, where familial echinococcosis is more prevalent.

Key words: familial echinococcosis; serological tests; cyst; surgical procedure

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INTRODUCTION

Human echinococcosis is a parasitic zoonosis caused by helminths belonging to the genus *Echinococcus*. The two clinical forms of greatest medical and social significance worldwide are cystic echinococcosis (CE) and alveolar echinococcosis (AE). Cystic echinococcosis, also referred to as hydatid disease or hydatidosis, results from infection with a species complex centred on *Echinococcus granulosus sensu lato*. Alveolar echinococcosis is caused by infection with *E. multilocularis* (1). Most human cases of AE in Europe are recorded in France, Germany, Switzerland, Austria, Lithuania, and Poland. In 2020, 77% of the 114 cases were recorded in Germany and France (2). Cystic echinococcosis (CE) is significantly more frequent in humans, and has an endemic distribution in several countries from the Mediterranean and Eastern Europe, Central Asia, China, North and Sub-Saharan Africa, and South America (3). The endemicity of CE is attributed to biotic and abiotic factors. A range of behavioral and socioeconomic factors (e.g. agricultural activities including traditional sheep rearing and farming practices, contact with dogs, geophagy, outdoor activities or contaminated food or water) that may facilitate the ingestion of *E. granulosus* eggs influence the transmission of this infection in humans (4). Human CE is a foodborne parasitic disease that can have a severe prolonged clinical course, leading in some cases to disability. Relapses following treatment are common, with potential for permanent disability and even death (5). It is of utmost importance to implement adequate surveillance and control measures for CE, in order to limit the spread of this infection in the community.

Cystic echinococcosis (CE) is endemic in Bulgaria, affecting individuals of all sexes and age groups. Regrettably, in recent years the highest notification rates among the Member States of the European Union have been registered in Bulgaria. While Bulgaria accounts for most cystic echinococcosis cases in the EU in 2020 (39%), there has been a 65% overall decrease of registered cases from 269 in 2016 to 95 in 2020 (2).

The transmission mechanisms suggest that multiple family members may be affected, with patients often unaware of the disease for an extended period of time due to the lack of specific symptoms. This paper

presents a rare case of familial echinococcosis affecting all family members (n=4) and reviews literature concerning this issue. The cases are presented chronologically according to the time of diagnosis.

CASE REPORTS

Case 1

A 43-year-old male residing in a small town in the northeastern region of Bulgaria. He has completed only the primary education level and was employed as a livestock farmer. The patient presented with a constellation of symptoms, including fever up to 40°C, productive cough, chest pain, shortness of breath, and a 12-kg weight reduction over eight months. The results of clinical-laboratory tests revealed: erythrocyte sedimentation rate (ESR) 73 mm/h, Hb 139 g/l; Er 4.75x1012/l; Eo 0.03 x109/l. A chest X-ray was performed due to suspicion of pneumonia, revealing two oval, smooth-walled formations, within the upper lobe of the right lung, each measuring 80 mm in length. The patient was admitted to a surgical clinic for diagnostic evaluation. A CT scan of the chest and abdominal organs was performed. Imaging revealed the presence of four cystic formations in both lobes of the lung - two oval, smooth-walled formations measuring 80 mm in the upper lobe of the right lung and two with the same characteristics at the base of the left lung. A large cyst measuring 120 mm was identified in the liver. Immunodiagnosis was carried out by an enzyme-linked immunosorbent assay (ELISA), which showed the presence of anti-echinococcal IgG antibodies.

A one-stage echinococcectomy was performed. Pathohistological analysis of the extracted cystic formations described chitinous membranes, which confirmed the diagnosis. The patient underwent postoperative chemoprophylaxis with albendazole in a dose of 800 mg/24h for 6 months.

According to the epidemiological survey, the patient had a dog that was not regularly dewormed and was fed with raw animal products. The man was in the habit of consuming unwashed fruit and vegetables and was not aware of the disease and its transmission mechanisms.

As a part of the anti-epidemic measures, the three other family members were tested for echinococcosis. Immunodiagnostic tests and imaging were performed, and all three were diagnosed with hydatidosis.

Case 2

Seventeen-year-old female, daughter of Case 1. She had a history of dermal hypersensitivity of unknown etiology since 2-3 years ago treated with antihistamines and corticosteroids. The woman had clinical symptoms of pneumonia lasting about a month. The serological test performed as a part of the epidemiological survey was positive for echinococcosis. The chest x-ray showed three round shadows in the left lobe with smooth and sharp outlines measuring 60x70 mm and two cystic formations with connection to the hilus and a dense shadow in the hilus itself, as well as atelectasis on the right side. Pulmonic echinococcosis was concluded. Abdominal ultrasound revealed the presence of multiple cysts of varying sizes and shapes, some of which - septated. Four cysts were observed between the spleen and the diaphragm. The young patient was hospitalized for further diagnostic evaluation and treatment in the Pediatric Surgery Department of the regional hospital. On admission to the medical facility, the general condition of the patient was satisfactory, with low fever and persistent, dry, nonproductive cough. Physical examination revealed pure vesicular breathing with single dry wheezes. The liver was painless, with a soft-elastic consistency, enlarged (3-4 cm below the costal arc). The clinical-laboratory analyzes showed: ESR 110 mm/h; Hb 143 g/l, Er 4.85 x 1012/l, Leu 16.9 x 109/l. A differential leukocyte count on a peripheral blood smear showed: St 3%, Sg 45%, Ly 32%, Mo 3%, Eo 17%. Liver biochemistry: aspartate aminotransferase (ASAT) 27 U/L (10-40); alanine aminotransferase (ALAT) 63 U/L (10-35); gamma-glutamyl transpeptidase (GGTP) 203 U/L (6-54). The diagnosis of multiple echinococcosis was based on imaging data, positive serological tests for echinococcosis, clinical-laboratory analyses, and the history of a family member with proven echinococcosis. A CT scan of the head showed no formations suspicious for echinococcal cysts. In the right lung lobe, in the VI segment, bilaterally well-shaped elliptical formations with thin walls, water-equivalent content and an average size of 40x45 mm were visualized. One of the formations was drained

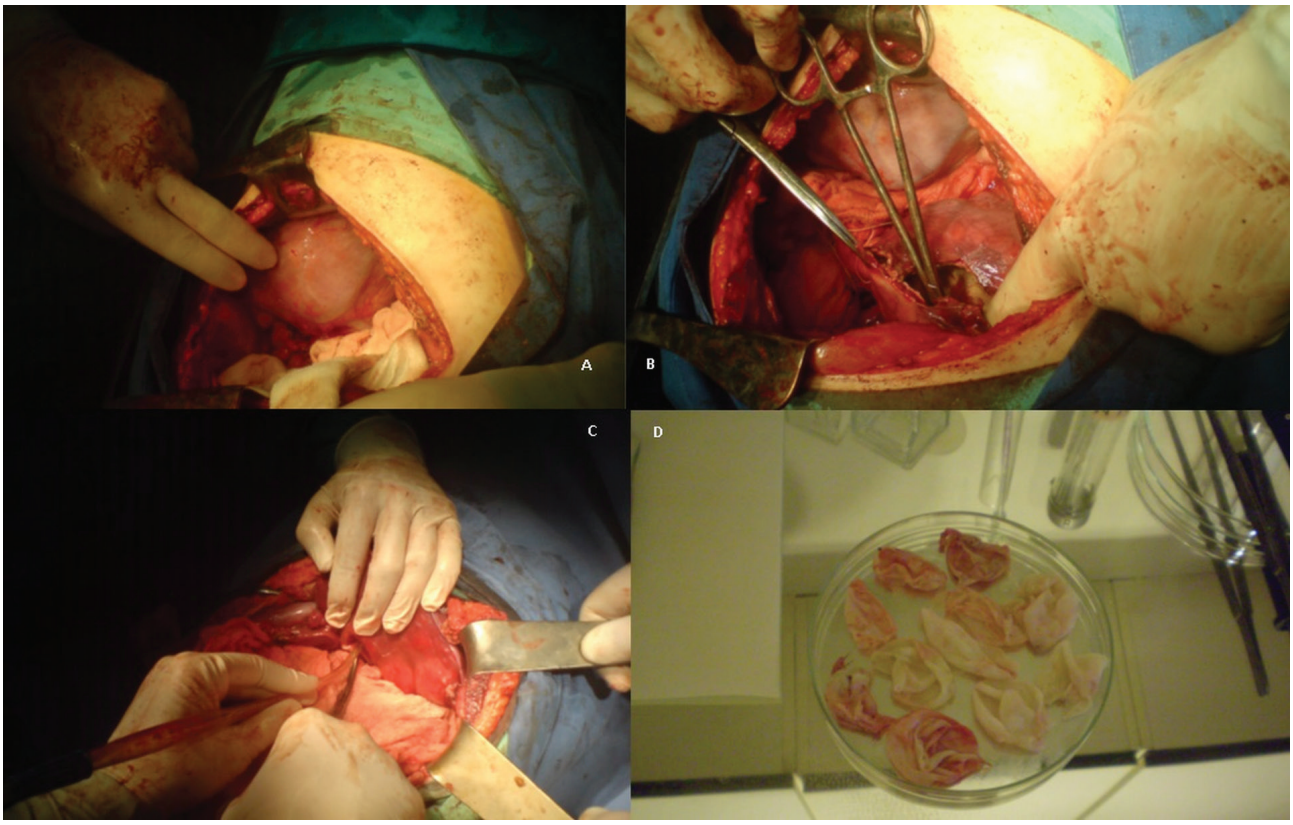

Figure 1. The stages of surgical intervention (A, B, C) and the capsules of extracted echinococcal cysts (C) are presented.

into the bronchial tree. There was evidence of inflammation around a cyst with a diameter of 9x10 mm in the right lower lobe. CT-scan of the abdominal cavity revealed multiple cystic formations in the liver, with thin walls and sizes between 7 and 10 mm. Cysts were also found in the left lateral subdiaphragmatic area. Five echinococcal cysts were surgically removed from the right lung and four from the right lobe of the liver (Fig. 1).

The surgical material was subjected to histological examination, which revealed the presence of an echinococcal cyst, a cyst capsule, and cyst fluid. The presence of viable and invasive protoscolices was confirmed (Fig. 2).

The patient underwent a second operation one month after the initial procedure, during which three

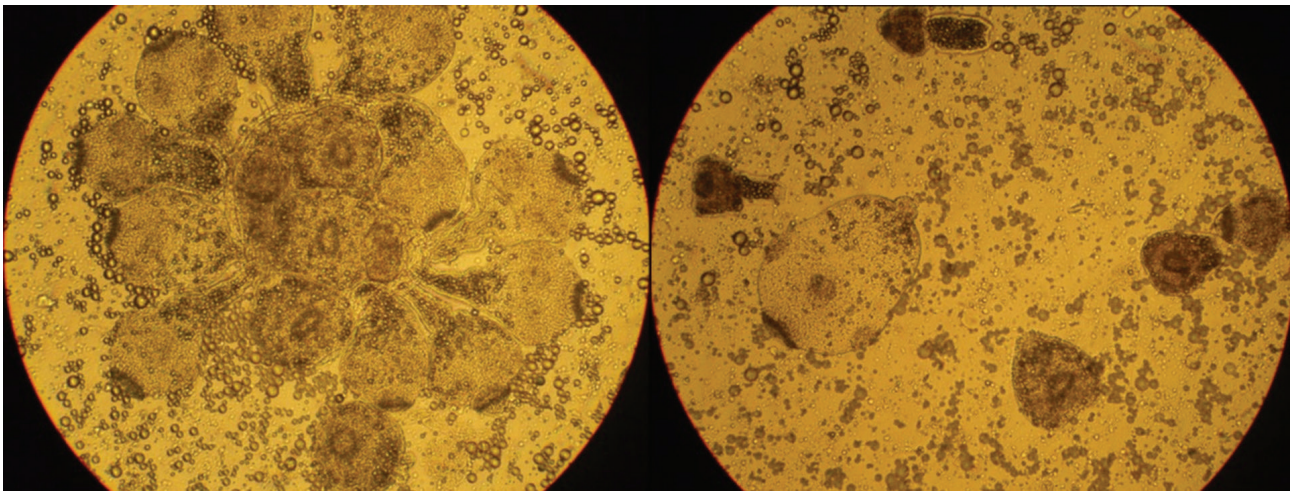

Figure 2. *Echinococcus granulosus* protoscolices in echinococcal fluid from surgically removed cysts (magnification x 400).

echinococcal cysts were removed from the left lung. A third operation was performed two months after the second operation, during which 24 echinococcal cysts were removed from the liver. Postoperatively, six one-month courses of albendazole were administered by the recommended regimen 10 mg/kg of body weight daily in 2 divided doses

Case 3

A 39-year-old woman, the wife of Case 1, with primary education level and no employment, was examined for epidemiological indications. Serological data showed the presence of specific anti-echinococcal antibodies. Ultrasonography of the abdominal organs showed the presence of an approximately 8 cm cyst with daughter cysts involving segments VII and VIII of the liver.

The peripheral blood parameters were within the reference ranges. The patient presented no subjective symptoms but was referred to the regional hospital for admission and treatment. A cyst was subsequently removed via surgical intervention.

The epidemiological study revealed that the woman had frequent contact with the family's pet yard dog, which had not been dewormed. Furthermore, the patient had no knowledge of CE disease and its transmission mechanisms.

Case 4

A 22-year-old woman, daughter of Case 1 living in the same household. She had a secondary education level and was currently unemployed. She had no complaints and was actively diagnosed as a part of the epidemiological survey conducted due to her father's illness. Echinococcosis was proven by positive serological tests for antibodies to *Echinococcus granulosus* and imaging results. Ultrasonography visualized multiple cysts of different calibres in the liver, measuring between 15 and 50 mm, with well-formed walls, some of them annular, and calcium deposits.

Given the multiple hepatic echinococcosis, the relatively small sizes of the cysts and the ultrasound data of partial devitalization in two cases, only conservative chemotherapy was applied with albendazole in a dose of 10 mg/kg body weight daily in 2 divided doses, for six month. The disease course was favorable, with involution of echinococcal cysts. Again, the epidemiological survey established lack of knowledge about the zoonosis and the mechanisms of its transmission.

DISCUSSION

The term "echinococcosis" is used to describe a synanthropic and naturally occurring zooanthroponosis. The epidemic and epizootic processes are sustained within the synanthropic focus, facilitated by the prevailing lack of health education, the irresponsibility of domestic animals owners and the high population of stray dogs. Humans serve as accidental intermediate hosts for the echinococcal tapeworm, yet they have no epidemiological significance for its spread. However, when infected, they experience significant health damage. Disease cases are typically sporadic and disseminated in both rural and urban settings. With a notable spread of the disease nationwide, it is possible to observe parasitic outbreaks limited to individual households, with several disease cases within them (6, 7).

Nevertheless, the available literature data on such cases is relatively scarce. Two comparable studies were published for Bulgaria. One of them presents a clinical series of 15 families, with either both spouses affected (in 3 families), or - both spouses and the child, (in 9 families), or - the mother and the child (4), or - the grandmother and a grandchild (2). All cases were diagnosed at the same time and the source of infection was assumed to be the same (8). The second study covered six families (with a total of 26 individuals) with two CE patients in each of them - a total of 12 patients. Eight patients (66.7%) were 19 years old, and four (33.3%) were children and adolescents. CE had most often liver localization (7 patients, 58.3%), followed by pulmonary (2, 16.7%), combined lung and liver localization (2) and combined lung and spleen - in one of the patients (8.3%). Three of the families were from the Roma ethnic community. According to the history, five of the families were keeping a pet dog, but did not consider the risk of infection and did not deworm it regularly (9). Similar cases have been described in Romania and Turkey (10, 11).

Our case study is similar to the published ones. First, the presence of multiple cases of cystic echinococcosis in the same family may be attributed to the fact that all patients were exposed to the same risk factors, such as contact with potentially infected

dogs, ingestion of water and food that may have been contaminated with *Echinococcus granulosus* eggs, and lack of adequate hygiene habits. Additionally, the patients resided in endemic regions with developed sheep breeding (10). It is imperative to consider the educational, health-related, and cultural peculiarities of the affected individuals. In the present case the parents had only a primary level of education, one daughter was a student, and the other one had completed secondary education and was unemployed. None of the patients demonstrated any awareness of CE or the importance of deworming measures, or the risks associated with raw meat feeding of domestic dogs. Another similarity between the Bulgarian studies, is that of 22 families with more than one family member affected, 13 (59%) were from a minor ethnic community (Roma, Turkish). In our opinion, the cultural and social characteristics of these groups exert a considerable influence on the transmission of the disease among the population.

A further common conclusion of the published studies is the importance of timely family screening when diagnosing a case of CE in a family member. An effective evaluation of all family members at the time of the first case of hydatid disease diagnosis provides an opportunity for rapid diagnosis of the disease in other family members (11).

In our case, all family members were diagnosed within a month of the initial case, and immediate treatment was promptly initiated. Except for one case (the 22-year-old daughter), all other family members underwent surgical treatment, followed by anti-relapse drug prophylaxis. The younger daughter had to undergo three surgical procedures due to the extensive number of echinococcal cysts and their multiorgan localisation. Except for the mother, all other family members were afflicted with multiple echinococcosis. The father and the younger daughter also presented with multiple organ involvement. This suggests a high level of exposure and concentration of ingested parasite eggs.

CONCLUSION

The seroepidemiological research on echinococcosis and imaging (ultrasound and X-ray) studies of seropositive individuals should be performed among risk groups to establish hidden morbidity, with particular attention to ethnic communities where familial echinococcosis is more prevalent. Targeted examination of environmental samples for possible persistent contamination with echinococcal eggs and associated risk of spreading the disease among human and animal hosts is recommended during epidemiological investigations of outbreaks of familial echinococcosis.

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