CASE REPORT

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Liver hydatid cyst – cause of violent death. Case presentation

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Abstract

Liver hydatid cyst represents one of the most frequent localizations of *Echinococcus granulosus* tapeworm in humans. The disease progresses symptom-free in most patients, due to a slow growth rhythm of the cyst. When it reaches large sizes, the hydatid cyst causes discomfort or pain in the liver bed, low appetite, phenomena of hepatitis or cholangitis. The patients are most often diagnosed with liver hydatid cyst after imagistic investigations (radiological or ultrasound) for symptoms that, most commonly, are not related to a hydatid cyst. We present the case of an 11-year-old girl, with no pathological history, who presented forme fruste symptoms, not acknowledged by her parents, and deceased after an anaphylactic shock caused by the rupture of a liver hydatid cyst.

Keywords: *Echinococcus granulosus*, zoonotic disease, hydatid cyst, inflammatory reaction.

Introduction

Hydatidosis is one of the most important zoonotic diseases, affecting health state both in animals and humans. In humans, the disease is caused by *Echinococcus granulosus* tapeworm in a larvae state [1]. *E. granulosus* is a worm belonging to the class of cestodes, 2–7 mm in length, made of a scolex with four suction valves, a rostrum with 36–40 hooks and 3–4 proglottids containing up to 800 eggs [2, 3]. The parasite presents two hosts: a "primary" or definitive host represented by dogs, cats, wolves and foxes and an "intermediary" host, represented by herbivore animals (especially sheep) and humans. The adult parasite lives in the primary host intestines, causing only intestinal parasitosis, for approximately five months, a period in which it produces millions of eggs that primary hosts eliminate by defecation [4].

Humans are accidental hosts and are not essential for the life cycle of *Echinococcus* tapeworm. The infection takes place after an accidental ingestion of the eggs. In the intestine, larvae are released from the eggs, the former entering the blood flow and reach the liver, lung, spleen, kidney, heart, central nervous system or other internal organs, where a cyst is formed (hydatid cyst) [5]. In humans, the localization of the hydatid cyst is mainly in the liver (50–70% of the cases), followed by the lung (20–30%); about 10% of hydatid cysts are found in other organs (spleen – 6%, heart – 2%, kidney – 2%, and brain – 2%) [6, 7].

The hydatid cyst represents a parasitosis that progresses endemically in South America, Eastern Europe, Russia, Middle East and China, where the incidence rates in humans are up to 50/100 000 inhabitants [4]. The disease prevalence varies from one geographical area to another, reaching 0.8–11.9% in Tibet communities in the West of China [8]. Some studies show that, at present, there are more than three million patients with echinococcosis [9, 10].

The disease progresses symptom-free in most patients, due to the slow growth rhythm of the cyst. When it reaches large sizes, the hydatid cyst causes discomfort or pain in the liver bed, low appetite, phenomena of hepatitis or cholangitis [11–13]. When there appear complications caused by the cyst rupture, the symptoms are polymorphic in nature.

We present the case of an 11-year-old girl from the rural area, which deceased suddenly after an abdominal injury, with the involvement of a liver giant hydatid cyst, followed by anaphylactic shock.

Case presentation

Patient S.A., aged 11 years old, from Podari Township, Livezi Village, Dolj County, Romania, on May 26th, 2013, around 8:30 AM, while playing in her home's yard, fell off, harming herself in the abdominal region. From the data provided by her parents, immediately after the injury, the girl presented intense pain in the right hypochondrium,

with an alteration of consciousness, and, after a short period, she deceased. The family declared that, after the injury event, the girl presented phenomena of respiratory failure ("she could not breathe") and generalized edemas (she was "swollen"). After a short time, there arrived an emergency team that, despite the cardiopulmonary resuscitation (CPR) procedures applied, had to declare the death.

According to the Romanian legislation, there was immediately begun a penal investigation, for elucidating the causes leading to death. Of the data provided by the police, we observed that the girl was not registered in the medical records with any medical pathological history, but her family declared that she had previously presented diffuse, intermittent abdominal pain (for a longer unspecified period of time) and loss of appetite. Despite all of these, the family did not pay too much attention to these symptoms and the girl was not presented to any doctor.

The girl lived in the rural area, in whose household there lived various domestic animals (dogs, cats, sheep, etc.). Also, the family stated that the girl loved animals very much, frequently playing with them.

For establishing the diagnosis and circumstances of death, the body was taken to the Institute of Forensics in Craiova, Romania. During autopsy, the first sign that draw our attention was the generalized edema, digital pressure leaving folds in all body regions (Figure 1, a and b). At external examination of the body, except for the edema and real death signs, there were observed marks of injections, without perilesional blood infiltrates (explained by the attempt of resuscitation) and an excoriation on the right knee covered by blood crust.

At internal examination of the body, there were observed generalized stasis and edema, including the swelling of the airways. The lungs had an asphyxia aspect, being heavy, emphysematous, hyperinflated, with multiple red areas subpleurally disseminated, in both lung areas (Tardieu petechiae) (Figure 2).

During the abdominal autopsy, at the *in situ* examination, there was observed the presence of a liver cystic formation, localized in the right lobe, prominent in the diaphragm side of the liver, whitish in color, sized 10.5/10/8.5 cm (Figure 3, a and b). There was performed the punction of the formation, being observed that the liquid inside was pink-colored (sanguinolent) (Figure 4). After sectioning the cystic formation, we observed that the wall was whitish, thick, with a spiral-like shape (Figure 5); also, the cyst contained another cystic formation inside, with similar characteristics to the one previously described (daughter vesicle), with the difference that the latter contained a clear liquid, like "rock water" and hydatid sand. The examination of the kidneys showed, in a longitudinal sectioning, a pale and thin cortical, with multiple fine striations and blood dots (Figure 6).

For completing the examination, there were harvested biological samples for complementary toxicological tests. The general toxicological test was negative for drugs or medicines.

For the histopathological (HP) study, there were harvested fragments from the heart, lung, spleen, kidney, liver and brain that were subsequently fixed in 10% neutral formalin solution and included in histological paraffin. From the liver, there were harvested fragments from the cyst wall and liver parenchyma, both in the immediate proximity of the cyst and at a more distal area. There were performed 4-µm thick sections in the paraffin microtome, followed by a Hematoxylin–Eosin (HE) staining.

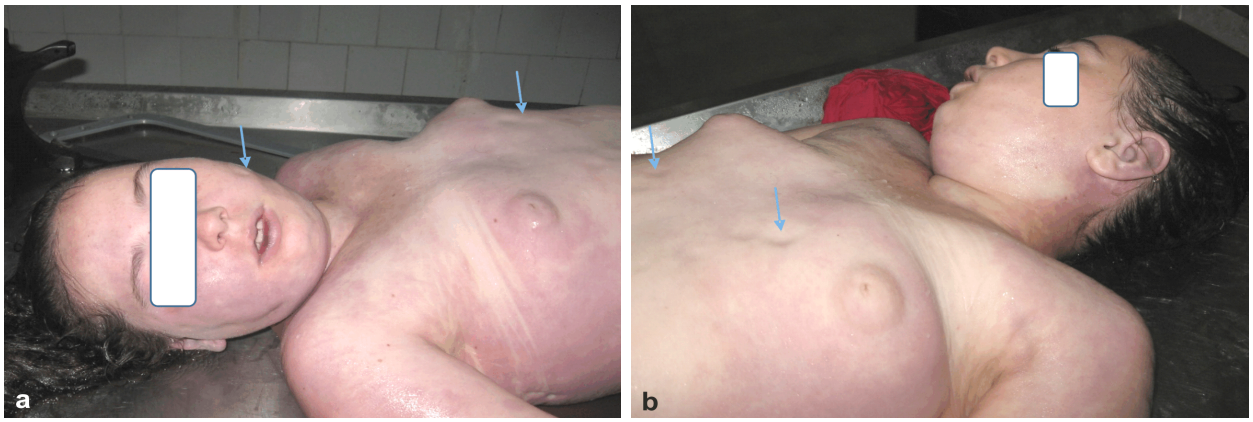


Figure 1 – ***(a and b) Examination of the body highlighted the presence of a generalized edema, leaving folds at digital pressure.***

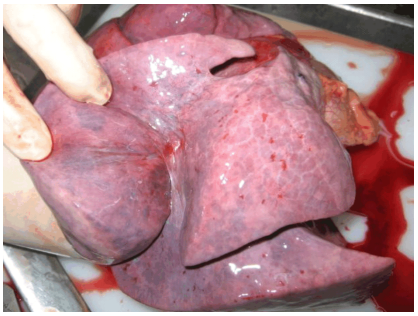
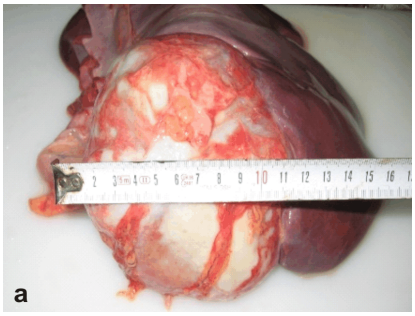


Figure 2 – ***Asphyxic lung with Tardieu petechiae localized subpleurally, disseminated in both lung areas.***



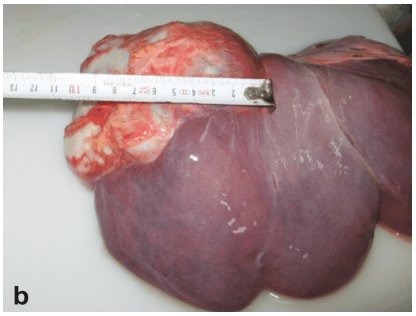


Figure 3 – ***(a and b) Macroscopic aspect of the liver hydatid cyst.***

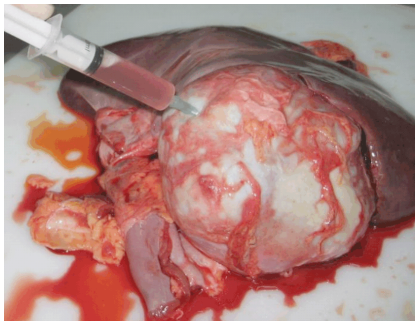


Figure 4 – ***Punctioning the cyst highlighted the presence of a sanguinolent liquid.***

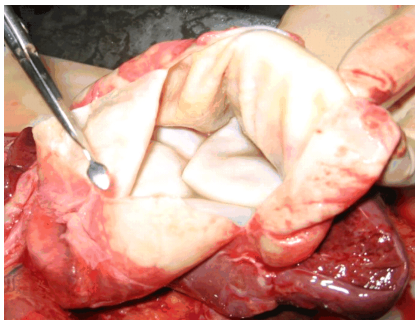


Figure 5 – ***Macroscopic aspect of the hydatid cyst membrane and of a "daughter vesicle".***

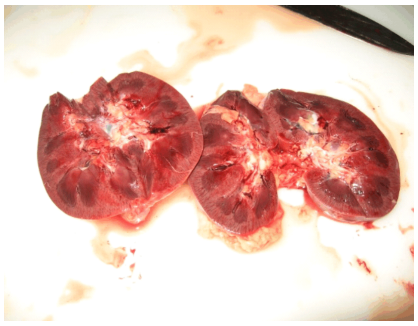


Figure 6 – ***Macroscopic section aspect of kidneys: there may be observed a pale cortical with multiple striations and blood dots.***

The microscopic examination of the cystic wall highlighted the presence of a thick fibrous capsule on the outside, rich in collagen fibers, doubled inside by the cyst membrane (germinal layer) of a much more reduced thickness, with numerous attached protoscoleces (Figures 7 and 8).

In the liver, the HP examination identified lesions of chronic hepatitis, with massive fibrosis and abundant inflammatory infiltrates in the portal spaces (Figure 9). The portal inflammatory infiltrate was mainly formed of lymphocytes, eosinophils, macrophages and multinucleate cells (Figures 10 and 11). In the liver parenchyma, there were identified numerous lymphocytes, and the hepatocytes presented lesions of cytolysis, granular and vacuolar degenerescence (Figure 12).

On the lungs, there was highlighted the presence of an acute lung edema, characterized by vascular congestion, thickness of interalveolar septa and the onset of an eosinophilic exudate in most alveoli (Figure 13 and 14).

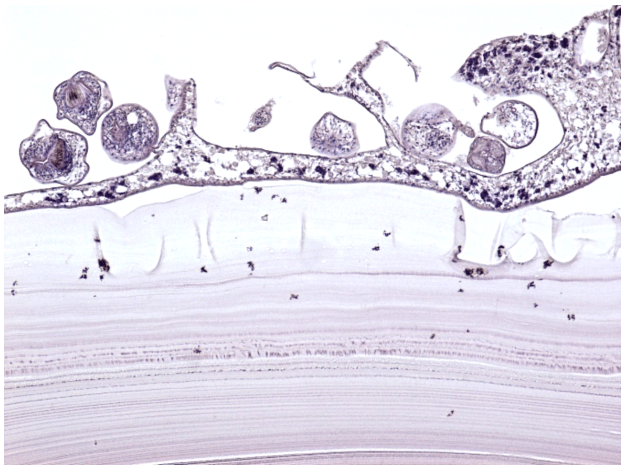


Figure 7 – ***Image of hydatid cyst wall, formed of a fibrous capsule at periphery, rich in collagen fibers and proligerus membrane with numerous protoscoleces (HE staining, ×100).***

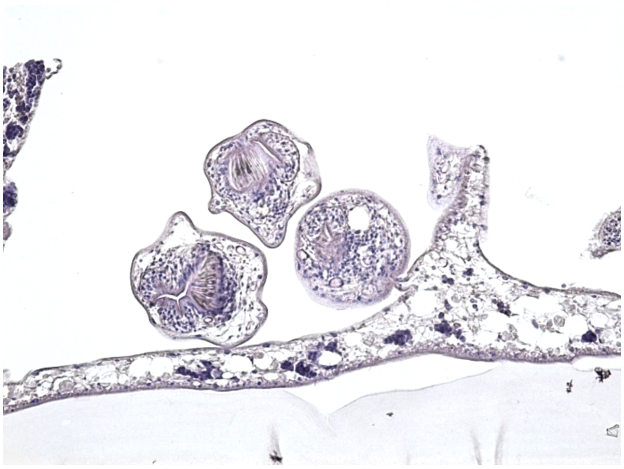


Figure 8 – ***Detail in the proligerus membrane of the hydatid cyst with well-structured protoscoleces (HE staining, ×200).***

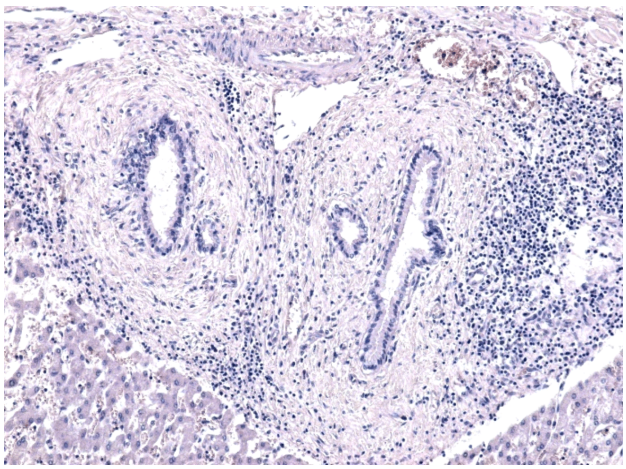


Figure 9 – ***Microscopic image of the liver where there may be observed the presence of an abundant inflammatory infiltrate, massive fibrosis and dilatation of biliary canalicules in the portal spaces (HE staining, ×100).***

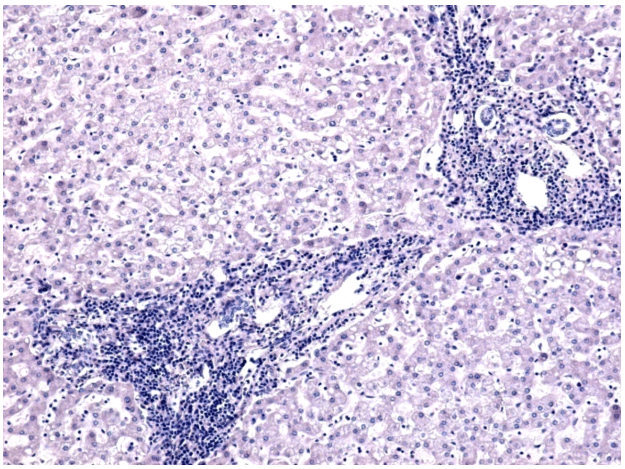


Figure 10 – ***Portal spaces with intense inflammatory infiltrates, portal fibrosis and a tendency to form porto-portal bridges (HE staining, ×100).***

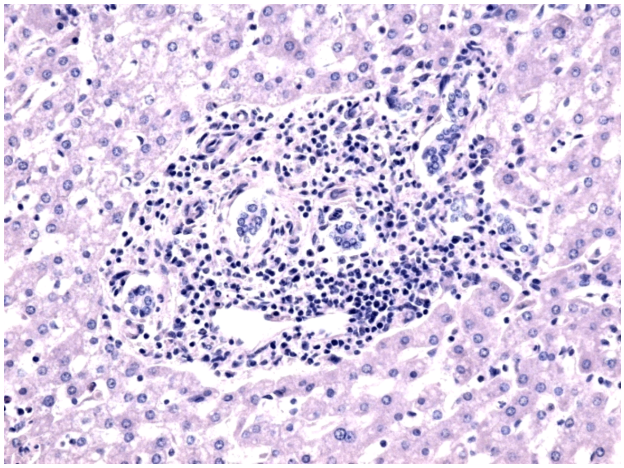


Figure 11 – ***Portal inflammatory infiltrate with numerous multinucleated cells (HE staining, ×200).***

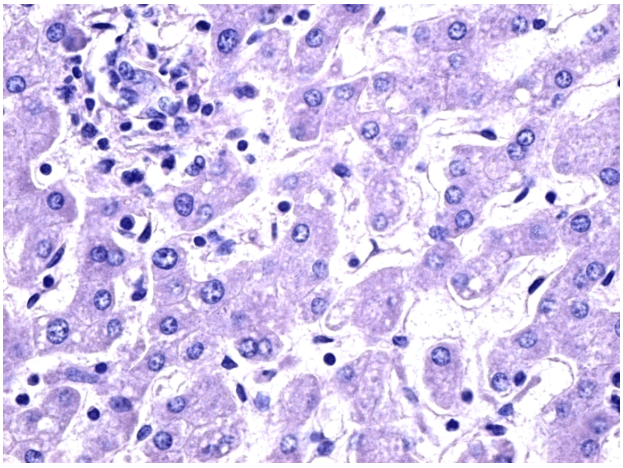


Figure 12 – ***Liver parenchyma with lesions of hepatocytolysis, granular and vacuolar degenerescence (HE staining, ×400).***

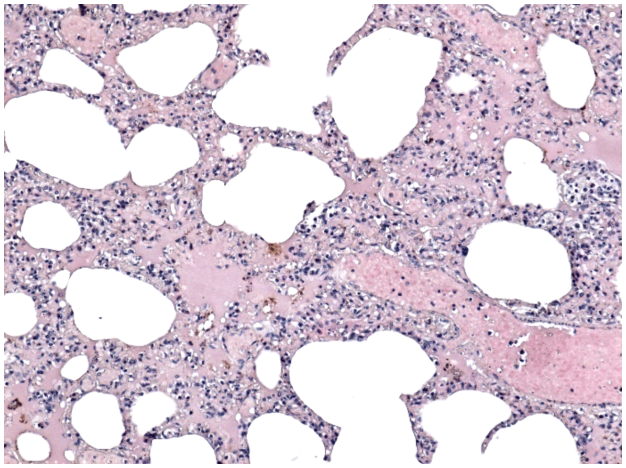


Figure 13 – ***Microscopic image of the lung parenchyma highlighting vascular congestion, thickness of alveolar septa and presence of an eosinophilic exudate in the lung alveoli (HE staining, ×100).***

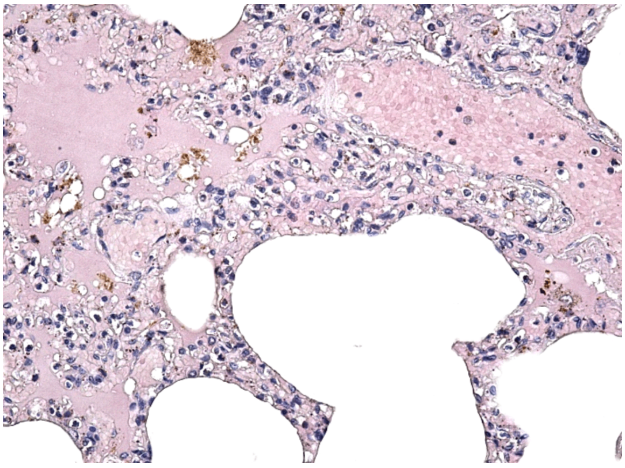


Figure 14 – ***Acute lung edema: detail from previous figure (HE staining, ×200).***

The microscopic examination of the heart, kidney, spleen and encephalus did not show any significant HP changes.

After performing additional examinations, in the forensics report there was concluded that there was a sudden, violent death, caused by an anaphylactic shock installed after the abdominal injury that affected the liver hydatid cyst. Also, in the report there was mentioned that between the injury and death there was a direct cause connection, conditioned by the presence of the hydatid cyst, the injury generating the anaphylactic shock by creating a communication between the hydatid liquid and blood vessels.

Discussions

We presented a case of liver hydatid disease, with no clinical signs, with a rapid, lethal progression, after a minor abdominal injury, in an 11-year-old girl. Numerous studies showed that hydatid disease is one of the most frequent zoonotic diseases in the world [14, 15], its early diagnosing being almost impossible, as there are no national screening programs at present, not even in countries where zoonosis progresses endemically. The incidence of the disease in ever growing, every year being recorded more than 200 000 new cases world widely [16, 17]. The annual economic losses caused by human *Echinococcus* infection are approximately 200–800 million dollars [18, 19].

Regarding Romania, some epidemiological studies showed that hydatid disease is one of the most important zoonotic diseases, echinococcosis being considered endemic in our country, due to the high number of reported cases in humans and animals. Thus, in 2011 there were reported 53 cases (0.25/100 000 inhabitants), placing Romania on the 5th place in the European Union, with an average of 0.18/100 000 reported cases [20].

In our opinion, the real number of the patients infected with *Echinococcus* is not known, as the disease progresses without symptoms for a long time. Thus, after ingesting the parasite eggs, they reach from the intestine to the portal venous blood and from here to the liver, lung, spleen, kidney, heart, brain or other organs, where it localizes and forms cysts. In liver echinococcosis, the cyst growth varies from 1–2 mm up to 10 mm per year [6], which makes clinical symptoms be absent most of the times, leaving the liver lesion undetected for many years [21, 22].

One of the particularities of our case was the onset of asphyxia phenomena, with sudden death of the patient who had no medical history of any disease. The diagnosis of disease and etiopathogenic circumstances of death were

performed only after the autopsy report. The retrospective analysis of the environment and life conditions identified some risk factors: presence of domestic animals in the family household (dogs, cats, cows, sheep), which is possible to have been infected with *E. granulosus* tapeworm and the child affection for animals, which shows the existence of a prolonged contact with them.

Although the hydatid cyst identified during autopsy had quite large sizes (about 10 cm in diameter), the clinical symptoms were scarce. The cyst size, related to the growth rhythm of the liver hydatid cyst and the girl's age, makes us believe that the infection with *E. granulosus* tapeworm happened in the first years of life.

The absence of clinical symptoms over a long period of time may also be due to a slow growth of the liver hydatid cyst and to a low immune response, according to some studies [21, 22]. The clinical symptoms are not specific in nature and their onset is when the liver hydatid cyst reaches maturity [12, 23]. They are mainly determined by the cyst volume that produces a mass effect, with multiple mechanical complications upon biliary ways (secondary cholestasis and even mechanic jaundice), upon blood vessels (portal high blood pressure and even the Budd–Chiari syndrome), upon stomach (secondary gastric hyperacidity), etc.

Most frequent symptoms are represented by abdominal discomfort with pains in the right hypochondrium [24], loss of appetite, postprandial bloating, itching, scleral or skin jaundice or sub-jaundice. During the physical examination, there may be established a hepatomegaly sensible to palpation and abdominal distention. The patients with reduced symptoms are most often diagnosed with liver hydatid cyst after imagistic examinations (X-ray or ultrasound) for symptoms that, most of the time, have no connection to the hydatid cyst [25, 26]. The symptoms become intense when there occurs a major complication: cyst rupture in the biliary ways, with phenomena of cholangitis due to biliary obstruction caused by daughter vesicles [24], ruptures in the intra-peritoneal cavity, secondary infections of the cyst, etc.

The symptoms presented by our patient were scarce, the parents mentioning that the girls accused intermittent diffuse abdominal pains and loss of appetite. Because they did not present to a doctor and the girl did not undergo paraclinical investigations, the disease could not be diagnosed during lifetime. The sudden onset of the symptoms, post-injury, with intense abdominal pains, followed by skin and face swelling, and the onset of phenomena of acute lung failure, show a rupture of the cyst with an intense anaphylactic reaction. The sanguinolent aspect of the liquid inside the hydatid cyst shows the rupture of the liver hydatid cyst and the onset of a communication with the circulatory system. More studies showed that the rupture of the liver hydatid cyst may cause an intense anaphylactic reaction that, left untreated, leads to death [27–31].

The HP examination performed highlighted the presence of an acute lung edema, most probably caused by an intense anaphylactic reaction, determined by the entrance of the hydatid liquid in the blood vessels. More studies showed that the cyst rupture, even in the peritoneal cavity, may lead to an anaphylactic shock that, in 4.6% of the cases, is followed by death [8, 32–34]. The anaphylactic shock is caused by specific immunoglobulins E (IgE) that, in the patients infected with *E. granulosus*, are found in large quantities [34–37].

In our case, the microscopic changes caused by the hydatid cyst in the liver were intense, similar to a chronic hepatitis, with abundant inflammatory infiltrates and fibrosis in the portal spaces, associated with hepatic cytolysis, granular and vacuolar degenerescence of hepatocytes. The particular aspect of the portal inflammatory infiltrates was represented by the presence of multinucleated cells.

Some studies showed that the *E. granulosus* infection induces an immune imbalance in the liver, having as a result a severe destruction of the liver architecture, onset of intense inflammatory infiltrates and formation of liver fibrosis [38, 39]. As shown by us, the inflammatory reaction induced by the parasite in the liver is quite complex and it involves T- and B-lymphocytes, macrophages, plasma cells, neutrophils and even eosinophils. Thus, similar to other chronic liver conditions [40, 41], in our case we also believe that there were activated the stellate liver (Ito) cells that are the main cells responsible for the production and deposit of conjunctive matrix and onset of liver fibrosis [42, 43].

Conclusions

In the presented case, the liver hydatid cyst had implications in generating a violent death, after an abdominal injury of low intensity, with no visible injury marking. The forensics examination made possible to determine the cause of death, and the HP examination contributed to elucidating the physiopathological mechanisms of death. Moreover, the microscopic examination highlighted the liver lesions induced by the hydatid cyst, thus confirming the macroscopic diagnosis. In such cases, the well-documented injury previous to the onset of anaphylactic reaction may also raise the suspicion of violent death – the interpretation may be extremely difficult, all the more so the injury may be the result of an aggression, and, subsequently, the evaluation of death as being non-violent may bring serious legal errors. Also, the medical investigation of minor symptoms in patients with risk factors may diagnose such conditions that may be treated medically or surgically, by avoiding such situations with a lethal potential.

Conflict of interests

The authors declare that they have no conflict of interests.

Authors' contribution

Marian Valentin Zorilă and Răzvan Ştefan Ţolescu equally contributed to this article.

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