



Massive hepatic echinococcosis in a backyard pig from Alba County, Romania

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Abstract. This case report documents a rare and severe occurrence of cystic echinococcosis in the liver of a 5-month-old pig (*Sus scrofa domestica*) from a small mixed farm. The pig presented with abdominal distension and prolonged decubitus while maintaining normal activity levels. Postmortem examination revealed an extremely enlarged liver, occupying most of the abdominal cavity, with hundreds of cysts measuring 2 to 10 mm in diameter, comprising 80–90% of the hepatic mass. The liver exhibited a light brown discoloration, and *Echinococcus granulosus* was confirmed as the causative agent. This case highlights the zoonotic potential of *Echinococcus granulosus*, emphasizing the importance of biosecurity and management practices in small-scale farms.

Key Words: *Echinococcus granulosus*, public health, shepherd dog.

Introduction. *Echinococcus granulosus*, a cestode of the Taeniidae family, is the causative agent of cystic echinococcosis (CE), also known as hydatid disease, a significant zoonosis with global health and economic implications (Scioscia et al 2016). The larval stage, or metacestode, develops into hydatid cysts primarily in the liver and lungs of intermediate hosts, including domestic ungulates, wildlife species, and occasionally humans (Chaligiannisa et al 2015). In humans, cystic echinococcosis can remain asymptomatic for prolonged periods, but its clinical spectrum ranges from benign infection to severe, life-threatening disease. When untreated or inadequately managed, the mortality rate can range from 2–4% or higher (Brunetti et al 2010). The disease's widespread prevalence and its substantial impact on global health have led organizations such as the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) to rank it as the second most impactful foodborne parasitic disease worldwide (FAO & WHO 2014).

The life cycle of *E. granulosus* involves dogs or other canids as definitive hosts, where adult tapeworms inhabit the intestinal tract, releasing eggs into the environment via feces (Eckert & Thompson 1988). Intermediate hosts, such as domestic ungulates, become infected by ingesting these eggs, leading to the development of hydatid cysts in their organs. The consumption of infected offal by definitive hosts perpetuates the parasite's life cycle. In addition to domestic animals, wildlife species can serve as intermediate or definitive hosts, facilitating spillovers between domestic and sylvatic cycles (Carmena & Cardona 2013). This adaptability underscores the parasite's formidable potential to thrive in diverse ecological settings (Craig et al 2007).

Cystic echinococcosis is endemic in many regions, including parts of Europe, Africa, and Asia. In Eastern Europe, the pig strain of *E. granulosus* has been identified as a key component of the parasite's life cycle, relying on free-roaming dogs, home slaughtering of infected pigs, and hunting of wild boars for its perpetuation (Schneider et al 2010; Paoletti et al 2019; Genchi et al 2021). While this strain is considered less infective to humans compared to other variants, it still poses significant challenges for both public and veterinary health (Thompson & McManus 2001).

In Romania, cystic echinococcosis is endemic, impacting humans and various domestic animal species, including sheep, cattle, and swine (Bart et al 2005). Beyond its public health implications, the disease also presents ecological and economic challenges, particularly in rural areas where traditional husbandry practices facilitate the parasite's transmission (Malczewski 2002). The adaptability of *E. granulosus* to different hosts and its ability to establish transmission cycles in small mixed farms underscore the importance of surveillance and control measures (Eckert et al 2000).

This report documents a rare case of cystic echinococcosis in a 5-month-old pig from a rural mixed farm in Romania. By examining the clinical presentation, pathological findings, and epidemiological context, this study aims to contribute to the understanding of *E. granulosus* infections in pigs, an intermediate host that remains understudied yet plays a critical role in maintaining transmission cycles in specific regions.

Case description

Farm description. A 5-month-old pig from a small mixed farm in a rural, hilly area, in Alba County of Romania, was slaughtered following a progressive onset of abdominal distension and prolonged periods of decubitus. Despite these symptoms, the pig remained alert and active, showing no signs of systemic illness or apathy. The farm operated with minimal infrastructure, housing a single sow and six piglets in a wooden shelter that had previously been used as a sheepfold. This shelter, alongside outdoor access, provided ample exposure to potential environmental factors.

The pigs were raised in close proximity to freely roaming shepherd dogs, which served as livestock guardians and were often in direct contact with the animals. Feeding practices on the farm included household food scraps for the pigs, while the dogs were fed raw slaughterhouse remains and wild boar carcasses, a routine linked to the hunting activities of the farm owners.

Parasitic prevention measures were implemented once, with the piglets receiving a single dose of bromamectin at six weeks of age. However, no further deworming or preventive treatments were administered. Additionally, the presence of rodents, including mice and rats, was observed on the property, potentially contributing to contamination risks. The shelter's prior use as a sheepfold raised the possibility of lingering environmental factors affecting the health of the pigs.

Gross description. The liver was markedly enlarged, occupying the majority of the abdominal cavity (Figure 1). Its external surface appeared irregular and nodular, with a pale brown discoloration. On cross-section, the hepatic parenchyma was replaced by hundreds of cystic structures, varying in size from 2 mm to 10 mm in diameter. These cysts contained clear, watery fluid and were surrounded by thin, translucent walls.

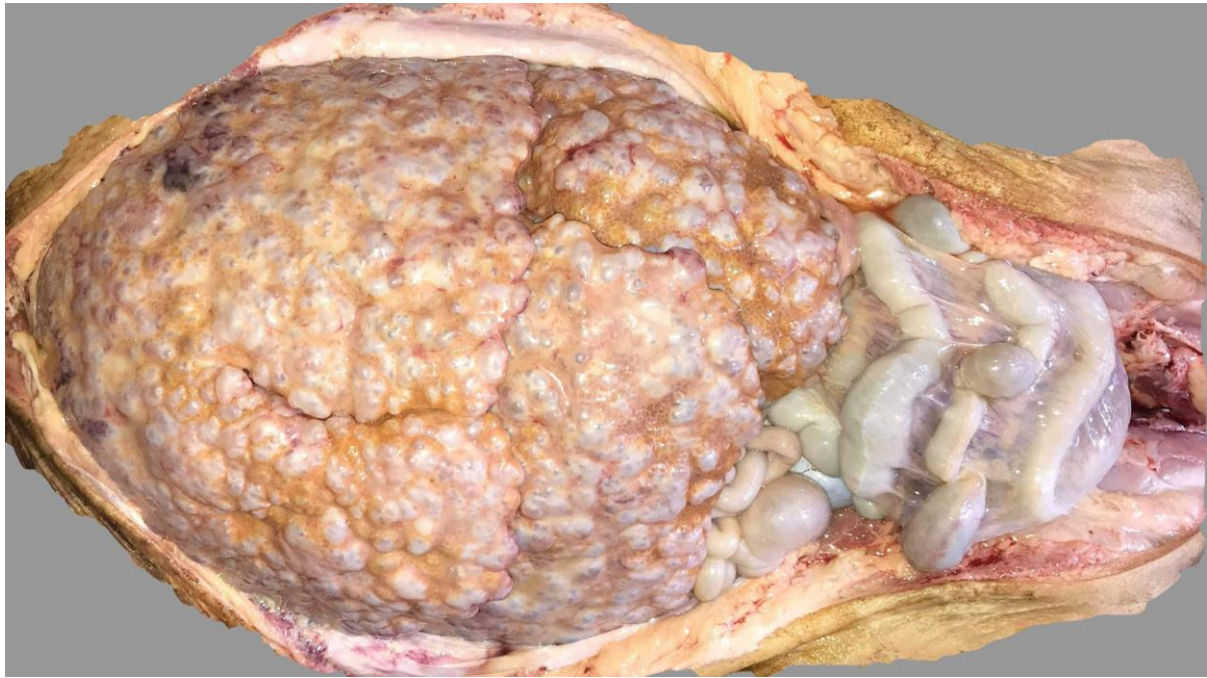


Figure 1. Gross appearance of the abdominal cavity. The image shows the open abdominal cavity of the pig, revealing a massively enlarged liver occupying the majority of the abdominal space. The liver's abnormal size and position have displaced adjacent organs, emphasizing the severity of the lesion. The surrounding tissues appear unremarkable, with no visible signs of peritonitis or secondary complications (original image).

The cysts occupied approximately 80–90% of the total hepatic mass, leaving only narrow bands of compressed, atrophic liver tissue between them. The remaining parenchyma appeared firm and pale, consistent with chronic compression. No evidence of rupture or leakage of the cyst contents was observed grossly, though some of the cyst walls appeared thinned and fragile.

The bile ducts and vasculature were not clearly identifiable due to the extensive replacement of hepatic tissue by the cystic lesions. The overall appearance of the liver was consistent with advanced parasitic cystic infiltration, severely compromising the organ's structural and functional integrity (Figure 2).

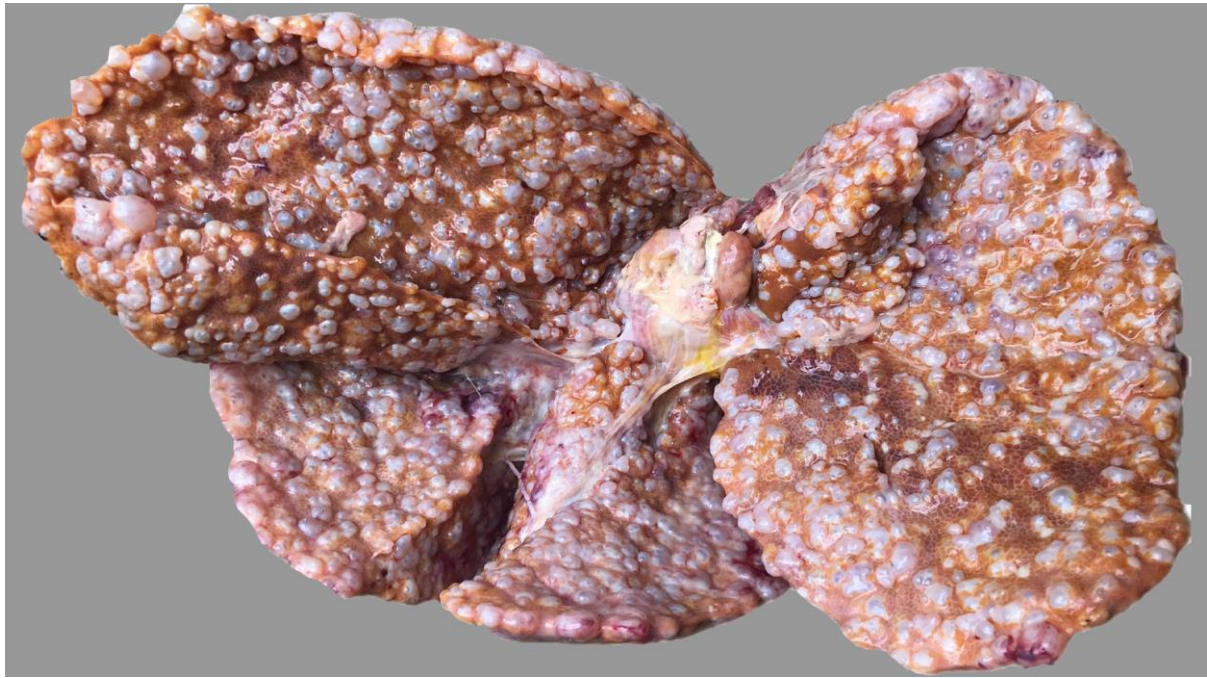


Figure 2. Close-up view of the liver with extensive cystic lesions. The liver is markedly enlarged and light brown in color, with its parenchyma mostly replaced by hundreds of fluid-filled cysts ranging in size from 2 to 10 mm. The cystic structures are distributed throughout the organ, occupying approximately 80–90% of its total mass. The remaining liver tissue appears compressed and atrophic, with a firm consistency. This image vividly illustrates the gross pathology of hepatic echinococcosis caused by *Echinococcus granulosus* (original image).

Histopathological description. Microscopic examination of the liver revealed extensive multifocal granulomatous inflammation surrounding parasitic cystic structures. The cysts, characterized by an outer laminated membrane and an inner germinal layer, were filled with numerous protoscolices and granular debris. Adjacent hepatic parenchyma exhibited marked compression atrophy due to the expanding cysts.

The granulomas surrounding the cysts consisted of a dense infiltration of mononuclear inflammatory cells, including macrophages, lymphocytes, and plasma cells, interspersed with multinucleated giant cells. These inflammatory cells were arranged concentrically around the parasitic structures, with an outer zone of fibroblasts and newly formed collagen indicating chronicity.

Scattered areas of hepatic necrosis were observed, likely secondary to pressure exerted by the cysts. The hepatocytes in these regions appeared shrunken with eosinophilic cytoplasm and pyknotic nuclei, consistent with coagulative necrosis. Mild to moderate biliary hyperplasia and periportal fibrosis were noted in affected areas, reflecting ongoing hepatic remodeling.

Additional findings included mild infiltration of neutrophils in areas where cystic rupture was suspected, indicating localized acute inflammation. Sinusoids in the surrounding liver parenchyma were dilated, and Kupffer cells were hypertrophic, likely reflecting increased phagocytic activity.

No evidence of significant vascular invasion or extrahepatic spread was observed in the examined sections.

Parasitological examination. Parasitological examination of the hepatic cysts was conducted to confirm the diagnosis. During gross examination, several cysts were aspirated to collect their fluid contents and inspect them microscopically. The cyst fluid was transparent and contained visible particulate material, commonly referred to as "hydatid sand".

Microscopic examination of the hydatid sand revealed numerous protoscolices, the larval stage of *Echinococcus granulosus*. These protoscolices appeared as small, ovoid structures with clearly defined hooklets, characteristic of *Echinococcus granulosus*. The presence of calcareous corpuscles, small mineralized bodies found within the cyst fluid, provided additional confirmation of the parasitic nature of the lesions.

The cyst walls were examined, revealing a typical laminated outer membrane and germinal layer. This dual-layered structure, combined with the findings of protoscolices and hydatid sand, confirmed the diagnosis of cystic echinococcosis caused by *Echinococcus granulosus*. No signs of cyst rupture or bacterial infection were found in the aspirated fluid.

These findings provided conclusive evidence of *Echinococcus granulosus* infection and supported the gross and histopathological observations, establishing the parasitic etiology of the hepatic lesions.

Conclusions. This case represents an extraordinary instance of cystic echinococcosis in a pig, with a massive hepatic infestation that highlights the potential for severe clinical and pathological outcomes. The epidemiological investigation revealed multiple risk factors for transmission. The presence of shepherd dogs as definitive hosts, the historical use of the shelter as sheepfold, and the feeding of raw wild boar remains to dogs likely perpetuated the parasite's life cycle. Environmental contamination with *Echinococcus granulosus* eggs, introduced by the dogs, provided an infection source for the pig.

The extent of hepatic involvement in this case is notable. The massive enlargement and near-total replacement of liver parenchyma by cysts are rare in pigs, given their status as less common intermediate hosts. The observed light brown discoloration and compression atrophy of the remaining liver tissue were consistent with chronic damage secondary to parasitic infestation. Despite these extensive lesions, the pig's retention of normal activity levels underscores the ability of pigs to tolerate substantial hepatic compromise before exhibiting overt clinical signs.

Cystic echinococcosis poses a significant zoonotic risk, with humans as accidental intermediate hosts developing hydatid cysts in vital organs. This case emphasizes the critical need for preventive measures in small mixed farming systems. Deworming programs for dogs, proper disposal of raw animal remains, and restricting dog access to livestock areas are essential to breaking the transmission cycle. Education for farmers on the risks of *Echinococcus granulosus* can further reduce zoonotic transmission and improve farm biosecurity.

Conflict of interest. The authors declare that there is no conflict of interest.

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