Echinococcus granulosus infection in domestic pig – a case study

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Abstract
Hydatid disease is a serious human health concern, caused by cysts of the tapeworm parasite Echinococcus granulosus. The tapeworm occurs in dogs, with the intermediate life cycle stage (the 'hydatid cyst') forming in many warm-blooded animals as well as in humans. This case study consists in post slaughter examination of a sow raised in a sheep small farm. The sow was slaughtered because of progressive weakening. The results of necropsy and histology exams revealed the Echinococcus granulosus infection. In the 2-year-old sow carcass, multiple vesicular, whitish, variable-sized lesions, between 2 and 4 cm in diameter, were seen in the liver parenchyma. The definitive host of Echinococcus gransulosus is the dog, who has the taenia in its small intestine and excretes embryonated eggs in its scat. The intermediate hosts can be various, usually sheep, but we can also find it in pigs, among others, as well as people, as it is a zoonosis. Obtained data are relevant in designing regional control strategies to suppress the occurrence of disease in livestock and risk for humans to be infected.

Introduction

Cystic echinococcosis (CE) is an important zoonotic infection causing morbidity and mortality in humans and significant economic losses in livestock. Hydatid disease is a serious human health concern, caused by cysts of the tapeworm parasite *Echinococcus granulosus*. 10 different genotypes (G1-G10) of this parasite were identified by molecular techniques (Nakao et al., 2007).

In Europe *E. granulosus is* split into several distinct species (*E. multilocularis*, *E. equinus*, *E.granulosus* sensu stricto, *E. ortleppi*, and *Echinococcus* sp.) (Romig et al, 2006).

It is an emerging disease in many parts of the world, in particular in countries of Eastern Europe (Romig et al, 2006). In Lithuania, it has been noted a higher prevalence in pigs older than 1 year and also in animals from family farms as compared with pigs from industrial farms (Bružinskaitė et al, 2009). The tapeworm occurs in dogs, with the intermediate life cycle stage (the 'hydatid cyst') forming in many warm-blooded animals as well as in humans and is regarded as one of the most widespread zoonoses (Craig et al, 2007). Its lifecycle is almost exclusively domestic, involving dogs as definitive and (predominantly) sheep as intermediate hosts. Moreover, high endemicity of this parasite depends on extensive sheep farming.

Material and methods

The present study was conducted in 2019 and consists in post slaughter examination of a sow raised in a sheep small farm. The sow was slaughtered because of progressive weakening. The affected organs (lung and liver) were examined for any gross alterations associated with the cysts. Tissue samples associated with hydatid cyst from lung and liver were collected and preserved in 10% formalin. The fixed tissue samples were processed by routine paraffin embedding technique. Briefly, the samples were cut into pieces of thickness 2–3 mm and washed under water for a few hours prior to dehydrating in ascending grades of alcohol and later cleared in benzene and embedded in paraffin. Tissue sections of 4–5 μm thickness were stained using the Periodic acid-Schiff (PAS) staining according to standard protocols.

Results and discussions

The definitive host of *Echinococcus granulosus* is the dog, who has the taenia in its small intestine and excretes embryonated eggs in its scat. The intermediate hosts can be various, usually sheep, but we can also find it in pigs, among others, as well as people, as it is a zoonosis.

Gross pathology. In the 2-year-old sow carcass, multiple vesicular, whitish, variable-sized lesions, between 2 and 4 cm in diameter, were seen in the lung and liver parenchyma. The cysts were either fully embedded in the parenchyma or were partially embedded when they were visible from the lung surface (fig.1). Both, dorsal and ventral aspect of the lungs were affected. Single to multiple cysts of varying size were observed from the visceral and/or parietal surfaces of liver (fig. 2).

Figure 1. Sow liver and lung with multiple hydatid cysts

In general the cysts were soft and doughy to touch and were filled with clear to slightly turbid fluid. On aspiration of fluid, the cyst collapsed and the cyst membrane, appearing creamy white, could be easily removed from the organ and its fluid contents were found clear to slightly turbid. However, some cysts were appearing firm and contained inspissated contents.

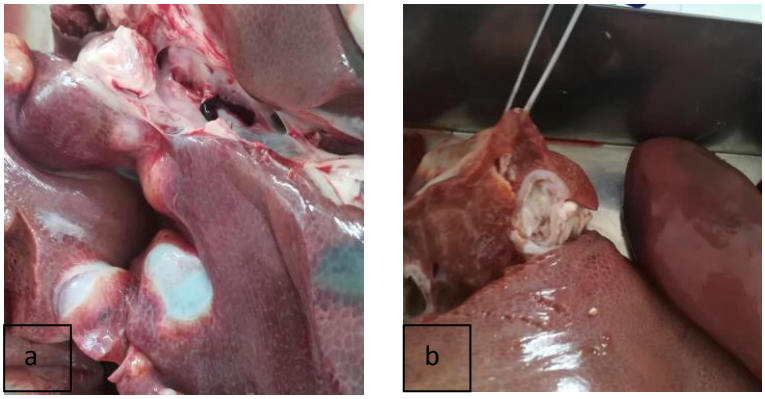

Figure 2. Liver **a**. parenchima with hydatid cysts; **b**. Liver section showing the inside of the vesicles

Histology. Data published in literature have shown that the initial development of the cyst is achieved very quickly (within 10–14 days) but its growth is slow being achieved in a variable time, depending on the species of the infected animal, its age and location. The time required for

formation of fertile cysts with complete structure is minimum 10 months in most species (Mitrea et al, 2012).

The investigation was performed on tissue sections: liver and lung, collected from a 2 years saw. The portions of harvested tissue were mainly on the cyst wall and the host tissue. For this study the histology of hydatid cyst detected in the 2 years' sow revealed that the structure of the latter is as follows: thick cuticle, proligerous membrane, visible and clear proligerous capsules.

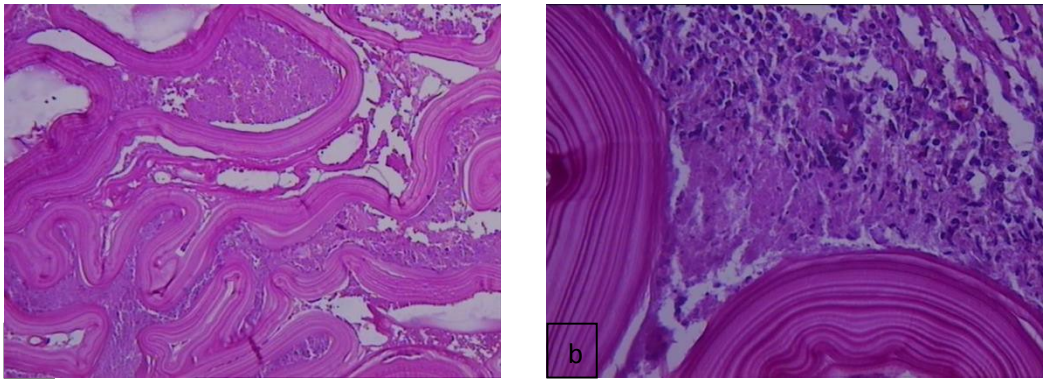

Figure 3. Pulmonary parenchima. **a**. Multilocular hydatid cysts, PAS stain x100;
b. Epithelioid and giant cell pericyst reaction, PAS stain x200

A discrete PAS-positive laminated membrane and a thicker adventitial, pericystic, layer of columnar macrophages, resting on a mineralising membrane. A diffuse mild infiltration with lymphocytes, macrophages plasma cells and granulocytes was also present.

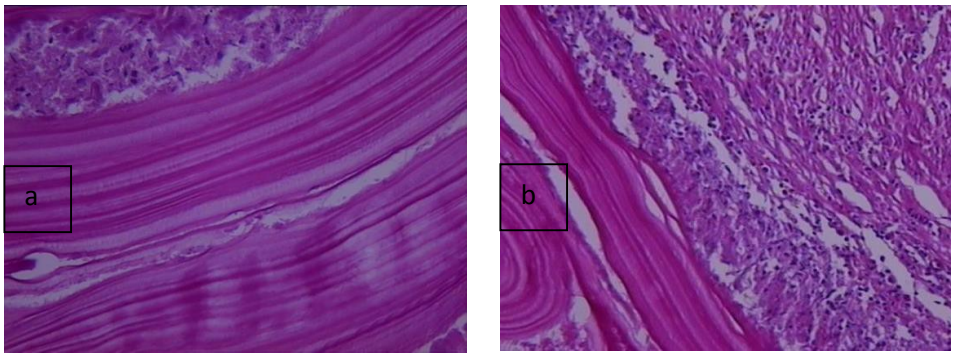

Figure 6. Liver parenchima. **a**. *The structure of hydatid cyst: endokyste (membrane proligerous); ectokyste (laminated embrane), PAS stain x100;* ***b***. *Formation of giant cell type contact between membrane and pericyst, PAS stain x100*

Histological investigations made in the study shows that the evolution of hydatid cyst in the host tissue is a complex form with all the mentioned morphology temporary and gradually due to multiple host-parasite relationships. The results are giant cells formation in contact between

membrane and cuticular pericyst, with epithelioid infiltration and multinucleated giant cells characterised as unipolar nuclei.

The presence of *E. granulosus* in swine might be attributed to the family farm organisation. In these farms, several animal species are generally kept together which facilitate the interspecies transmission of the parasite by dogs. Obtained data are relevant in designing regional control strategies to suppress the occurrence of disease in livestock and risk for humans to be infected. Our results corelates with previous published data (Mitrea et al, 2012; Mitrea et al, 2014) that emphasizes the hyperendemic presence of *E. granulosus* in Romania and outlines the necessity for the urgent development of sustainable surveillance and control strategies both in animals and humans.

Conclusions

The findings of *Echinococcus spp*. metacestode in a pig, from a private household, raise the question of the source of infection. Rural dogs, which are often kept to guard the sheep farm, may play an important role in the transmission of *Echinococcus granulosus* especially with infrequent anthelmintic treatment. Obtained data are relevant in designing regional control strategies to suppress the occurrence of disease in livestock and risk for humans to be infected.

References

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