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ECHINOCOCCUS GRANULOSUS OF DOMESTIC PIGS: A CASE CONTROL STUDY

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Abstract

Internal parasites of swine are very common in swine worldwide, sometimes compromising production and occasionally the cause of clinical disease. One of the most important zoonotic parasites that can be found in swine is a larval stage of *Echinococcus granulosus*. Adult *Echinococcus spp.* cestodes occur in carnivores, and their larval cysts (hydatids) occur in various herbivores and omnivores, including humans and swine. In carnivores, egg-laden proglottids pass with the faeces, contaminating the environment. When ingested by a pig, the larva (oncosphere) hatches in the small intestine, penetrates the intestinal wall, and enters the circulation. The liver stops about 70% of the oncospheres, where they nidate and develop into hydatids. Hydatic disease in pigs is not common finding on large swine farms, because biosecurity measuers are taken to prevent the contact of swine with carnivores. However, this is not a case with the backyards and free-range pigs, and they present the most frequent way of pig production in villages. The aim of the paper is to present a finding of intensive parasitic infection (hydatic disease) in backyards pigs. The material for this research included pigs from one backyard, where certain disorders and health problems in weaned pigs were detected. The applied research methods included: anamnestical and clinical evaluation, pathomorphological examination, parasitological laboratory testing for detection and determination the presence of parasites in the organs and tissue samples (liver, lung) derived from died pigs. Since in the evaluated backayard a sudden death in 10 weaners occurred, with unspecific clinical signs, the gross pathology examination of 2 dead weaners was performed. The nacropsy findings revealed the presence of enormous number of hydatid cysts on and in the liver tissue. Also, a large number of free parasitic cysts were found in the abdominal cavity. By parasitological examination of the liver and abdominal content, the presence of small parasitic cyst of *Echinococcus granulosus* (2-5 mm) was detected. Based on the achieved results, it can be concluded that *Echinococcus granulosus* infection is present in the backyards and free-roaming pigs, where husbandry methods allow direct contact with domestic and wild carnivores.

Keywords: backyards, domestic pigs, *Echinococcus granulosus*

Introduction

Hydatidosis in pigs is caused by larval form of *Echinococcus granulosus*. Echinococcosis/hydatidosis is a zoontic parasitic disease that poses a major health as well as economic threat all around the world. In the etiology of the disease, two stages can be discerned: 1) hydatid stage (cystic echinococcosis), which occurs in intermediate hosts (domestic and wild omnivores, herbivores and humans); and 2) echinococcosis stage, which occurs in the "dead-end" (definitive) hosts (animals from the families *Canidae* and *Felidae*), caused by the adult *Echinococcus spp.* (Brunetti and Filice, 2008).

In Serbia, the highest percentage of infected pigs can be found in backyard and free-range pig production systems (up to 75%). The percentage of infected pigs found on large swine farms (with biosecurity measures) is also not negligible and adds up to 10% (Pavlović et al., 1997).

A certain number of wild boars in our country are reared in controlled and enclosed hunting grounds, while a number of free-ranging populations are mainly unknown. One of the characteristics of outdoor swine production in some regions is raising free-roaming domestic pigs, where they share forest habitat with wild boars. Contacts between wild boars and domestic pigs kept in outdoor farms may occur occasionally. Since both animals have the same susceptibility to various infections including hydatidosis, there is a major concern to monitor the epidemiological situation of wild boars especially when control measures in domestic pigs are implemented (Prodanov-Radulović et al., 2014).

Uncharacteristically for tapeworms, the adult tapeworm is very small, only 5 mm in length. The eggs produced by the parasite are very light and resilient (Laaksonen and Paulsen, 2015). The infection of intermediate hosts occurs exclusively through the use of the contaminated water and food. The source of the *Echinococcus* eggs contamination is to be found in the faeces of "dead-end" (definitive) hosts, which is continuously being released into the external environment and ultimately consumed by the pigs (Pavlović and Ivanović, 2006).

The development process of the hydatic cysts is the same in all intermediate hosts, including humans. Once the digestive tract is reached, oncospheres (hexacanths) are released from the eggs, penetrating through the intestinal mucosa and reaching the capillaries, from where, through vena porta, the primary implantation site is reached - the liver (up to 70% share). Certain number of oncospheres that mash the liver, arrive at the right heart via vena cava, proceeding towards the lungs, the second most frequent implantation organ for hydatic cysts. The remaining hexacanths are transferred, through the left heart, towards the other parts of the organism – implanting kidneys, eyes and seldom brain and bones. When oncospheres (hexacanths) are fixed to the mucous membrane, the development of the cysts can begin. The cysts are continuously growing throughout the whole life of the intermediate host (Pavlović et al., 2011). Their size varies, depending on the duration of the infection, from barely noticeable to cysts of 150 mm in diameter. The cysts are often pearly grey colour and contain clear liquid with thousands of small, infectious larval forms of the parasite (Laaksonen and Paulsen, 2015). They are under considerable pressure and in the case of their rupture, the outcome is fatal.

In most of the cases the disease in pigs is asymptomatic and the losses primarily occur due to organ failures caused by the implanted cysts. There are three main factors contributing to the spreading of this infection in pigs: 1) the lack of pig breeders' and dog owners' knowledge concerning the life cycle of the parasite and concerning its epidemic potential; 2) the percentage (share) of the infected dogs as "dead-end" (definitive) hosts; and 3) hygienic circumstances, especially in pig breeding practices.

The aim of this paper is to widen the awareness of the possibility of *Echinococcus granulosus* epidemic mostly among the pigs bred in backyard and free-range pig production systems.

Material and Methods

The material for the investigation included one small family owned backyards swine farm (capacity of 5 sows), where the free-range was also practiced.

The Veterinary Inspection had informed the Scientific Veterinary Institute "Novi Sad" about the suspicion of the possible outbreak of classical swine fever in the family owned swine farm engaged in extensive swine breeding in the Srem region. Since in the evaluated backayard a sudden death in 10 weaners occurred, with unspecific clinical signs, the gross pathology examination of 2 dead weaners was performed. The samples from dead weaners were tested by RT-PCR method, in order to exclude the possibility of infection with classical swine fever virus.

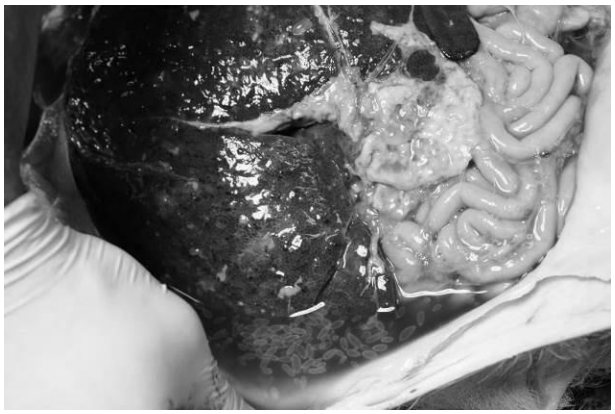
Since gross pathology findings had indicated the presence of significant pathomorphological changes, an additional parasitological testing was performed.

Results

During the external gross pathological pathomorphological examination of dead pigs, carried out in the backyard of the pig owner, a dirty slimy discharge of the nostrils was discovered at both pigs, as well as a strong cyanosis of the skin in the area of proboscis and earlobe base with visible yellow discoloration of the skin and mucous membranes. Mild palpebral oedema was also detected at one of the dead pigs. The internal gross pathological pathomorphological examination, on the other hand, revealed an amber coloured, free liquid, with fibrin strands in the chest cavity (Picture 1).

Picture 1. Chest and abdominal cavity: free liquid with fibrin strands

The examined tissues were also remarkable for mucosal and serosal yellow discolouration. Individual bleeding on the side parts of the diaphragmatic lobes were present in the lungs, as well as the hepatisation of apical and cardiac lobes. A few examples of *Metastrongylus spp.* were found in the lumens of bronchi and bronchioles. The mediastinal lymph nodes were unchanged. Tonsils, epiglottis, pharynx and larynx were also unchanged. The mandibular lymph nodes were unchanged. Extremely yellow discolouration of endocardium was discovered. In the abdominal cavity, the free liquid mixed with large amount of fibrin strands and free whitish, almost translucent, cystic formations, like “drops”, the size of grain of wheat or rice, also was found (Picture 2a and Picture 2b).



Picture 2a. Abdominal cavity: free liquid with fibrin strands and cystic formations

Picture 2b. Abdominal cavity: free liquid with fibrin strands and cystic formations

The liver was significantly enlarged with rounded edges and with a small but very numerous cystic formations protruding and dropping out of the liver tissue after cutting (Picture 3a). Hepatic hemorrhage with considerable structural defects was present (Picture 3b).

Picture 3a. Liver: hemorrhage and cystic formations dropping out of the liver tissue after cutting

Picture 3b. Liver: hemorrhage and cystic formations

The stomach was nearly empty, with expressed folds of mucous membranes and without changes in the mucosa. The small and large intestines were almost empty, with only a small amount of content and without changes in the mucous membrane. There was yellow discolouration of the kidneys with no changes either under the capsule or on the transverse section. The bladder was full of dense, distinctly yellow liquid content and without changes in the mucosa (Picture 4).

Picture 4. Slit bladder: dense, distinctly yellow liquid content

Discussion and conclusions

In Serbia, there are no official datasets of infection rates available for all the farms applying the backyard and free-range pig production systems, i. e. the slaughter is often carried out non-supervised by inspection service and without being reported. According to some recent investigations, infection rates vary widely across country between 4.6 and 57.6% (Ivanović and Pavlović, 1999). It has been established that around 75% of the infected pigs come from mini farms, applying the backyard and free-range pig production systems, mostly not maintaining strict biosecurity measures. Socio-economic factors as well as the lack of breeders' and dog owners' knowledge concerning the epidemiological features of the infection and the lack of adequate cemeteries for disposal of the deceased animals all contribute to the spread of this zoontic disease.

Considering the fact that echinococcosis/hydatidosis poses a major global threat, infection monitoring must be carried out with care and perseverance all over the world. For example, on the occasion of a pig slaughter in Lithuania, the examination of 684 pig livers revealed that significantly more infected animals came from mini farms (applying the backyard and free-range pig production systems and thus not maintaining strict biosecurity measures) then from large-scale farms (Bruzinskaite et al., 2009).

In order to make progress in the fight against echinococcosis/hydatidosis, it is necessary to cut off every rout of transmission of the infection. To this end, it should be made mandatory, that livestock slaughter process is always carried out in slaughterhouses, and under constant supervision of veterinary inspection services. It is also of paramount importance to report every case of the infection to the veterinary inspection service from where animal originate and to document it. The hygiene of the pig production practices and methods also affects the spread of the infection, which makes it extremely important to maintain strict biosecurity measures, which also means control on livestock movement, so that, in this particular case, the contact between the pigs and the intermediate and definitive hosts (dogs, i. e. their faeces) would be made impossible. The importance of widening of the global awareness of the problem as well as widening the access to the knowledge of infection should also be emphasised. Through education, which should start from school and also encompass instructing livestock breeders, butchers and dog owners on how to prevent the infection, everyone should be familiar with the basic facts concerning this infection. This education also means making wider public familiar with measures that should be undertaken, in order to combat this zoonosis more successfully. The measures also include the dog dehelmintisation, the control of dog movement and secure disposal of the organs contaminated with hydatic cysts (by boiling, burning or handling in animal shelters).

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