

# Acute Severe Visceral Cysticercosis in Lambs and Kids in Israel

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## ABSTRACT

This report describes two cases of acute outbreaks of cysticercosis in lambs and kids caused by *Cysticercus tenuicollis* the larval (metacestode) stage of the tapeworm *Taenia hydatigena*. The acute form of cysticercosis is rare and only a few cases have been described in the literature in the United Kingdom, Greece and Turkey. In the first case presented in this report 40% of lambs aged 2-3 months died over a period of 3-4 weeks during the month of March 2013. In the second case a few months later, 30% of lambs and 20% of kids succumbed. In both episodes adult sheep and goats were not affected. Pathological investigation revealed larval cestodes migrating through the liver and lungs. Investigation of the incidents led to the possibility that the main source of infestation was in the first case food borne in the concentrated feed manufactured by a local dealer, and in the second case due to contaminated hay harvested by the farmer and fed to the animals. The article describes the outbreaks, macroscopic and microscopic pathology findings and epidemiological investigations.

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**Keywords:** *Cysticercosis tenuicollis*; *Taenia hydatigena*; Age Susceptibility; Lambs; Kids; Epidemiological Investigation.

## INTRODUCTION

Cysticercosis in small ruminants is caused mainly by *Cysticercus tenuicollis*. Cysticercosis the larval (metacestode) stage of the tapeworm *Taenia hydatigena* appears in an acute or chronic form (1). The chronic form is more common, usually asymptomatic and is generally diagnosed at the abattoir (2). This form of the disease often results in economic losses due to condemnation of infected organs or carcasses.

The acute form of cysticercosis is rare and is usually seen in natural cases causing the death of a large number of lambs (1). Only a few cases have been described in the literature, in the United Kingdom (3), Greece (4), Italy (5) and Turkey (6). Sporadic cases on the other hand affecting solitary lambs have been described in Asian countries (7, 8).

This article describes two outbreaks of cysticercosis in lambs and kids which resulted in extensive mortality.

Investigation of the source of infestation led to a high suspicion on the contamination of food fed to these animals. The article describes the outbreak, macroscopic and microscopic pathology findings and epidemiological investigations.

## CASE REPORTS

### Case 1

Two lambs were found dead on the farm following a few days of lethargy were presented to the Pathology Department of the Kimron Veterinary Institute, Beit Dagan, Israel. Thirty six out of 90 lambs (40%) aged 2-3 months were reported by the farmer to have died over a period of 3-4 weeks during the month of March 2013 in a herd consisting of 400 ewes and 40 goats. Only lambs were affected. The farm was situated in the North of Israel in the Galilee. The ewes were mainly held

in paddocks and occasionally allowed to pasture, whereas the lambs were held only in the paddock enclosure.

The enclosure in which the lambs were held was surrounded by high concrete walls of about 1.5 meters and above which there was fencing up to the height of the roof. On inspection of the farm it was apparent that no canine access into the paddock enclosure was possible.

The farmer reported that the sheep were fed a commercial diet purchased and packaged by a local dealer. The farmer also reported that other farms in the area had complained about cases of mortality. Investigation of the incident led to the suspicion that the main source of infestation was probably food borne in the concentrate food.

## Case 2

Two lambs and one kid which died suddenly were presented to the Pathology Department of the Kimron Veterinary Institute, Beit Dagan, Israel. The farm from which they originated was situated in the centre of Israel and managed intensively. A total of 600 head were all held in enclosures without access to pastures. The farmer harvested hay for the sheep and goats from an adjacent vicinity just before the outbreak. On investigation the owner reported that the locale was known to be frequented by stray dogs and jackals.

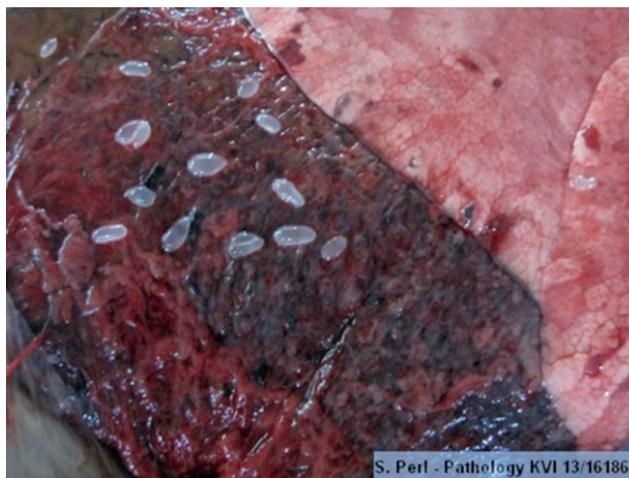
## Gross Pathology

A description of a typical case among the two outbreaks is presented.

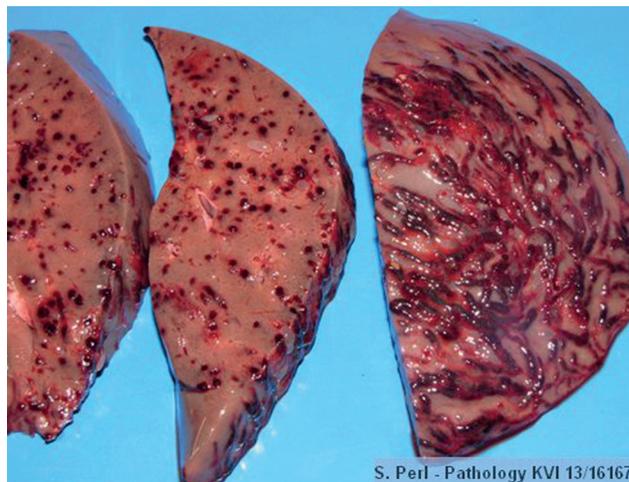
The liver was slightly enlarged and swollen, and its capsule covered by a thin layer of blood-tinged fibrin (Figure 1). Many 5-10 mm semi-translucent white cylindrical parasitic cysts were attached to the hepatic capsule (Figure 1). Within the capsule and the hepatic parenchyma there were multiple dark red streaks and canals, ranging from 1 to 3 cm in length and longer and 0.1- 0.2 cm in width (subcapsular and intra parenchymal migration tracts) (Figure 2).

After evisceration, within the pleural and peritoneal cavities there was approximately 500-800 ml of blood-tinged transudate with numerous semi-translucent white cysts (similar to those found on the liver) (Figure 3).

The lung was slightly edematous, and on the pleural surface a few parasitic migration tracts could be seen (Figure 4). A few cysts were attached to the visceral pleura and some of them appeared to have migrated through the lung parenchyma.



**Figure 1:** Liver and lung, lamb: The liver is dark red covered by a thin layer of blood tinged fibrin. A few cysts are penetrating the visceral pleura.



**Figure 2:** Liver, lamb: multifocal, numerous dark red migration tracts.

## HISTOPATHOLOGICAL DESCRIPTIONS

### Liver

Approximately 50% of the hepatic parenchyma was effaced and replaced by multiple randomly distributed, 2-3 mm wide, blood-filled cavities which were diagnosed as meta-zoan migration tracts. Within the cavities there were small numbers of eosinophils, neutrophils, and erythrocyte laden macrophages, admixed with necrotic cell debris, fibrin, and occasionally cestode larvae. The cestode larvae ranged in size from 5 to 10 mm in diameter, with a thick integument,



**Figure 3:** Lung, lamb: Multifocal hemorrhages and hemorrhagic streaks in the lung parenchyma due to migration of larvae.



**Figure 4:** Peritoneal cavity with a large volume of yellowish fluid and the presence of a large number of larval cysts.

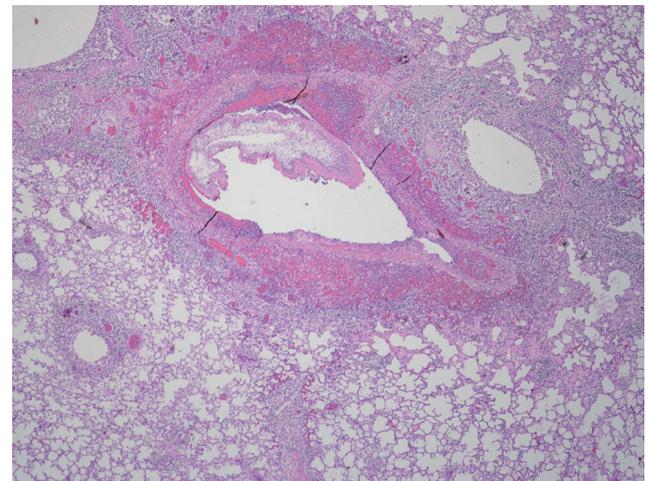
numerous calcareous corpuscles and no pseudocoelom or digestive tract. The migration tracts were surrounded by a rim of necrotic hepatocytes and a small numbers of lymphocytes, plasma cells and macrophages (Figure 5). Multifocally, there was a mild hepatocellular swelling and clearing with mild lipidosis.

### Lungs

Similar lesions to the liver were seen in the lungs. These consisted of blood-filled cavities randomly distributed in the lung parenchyma. In some of the cavities cestode larvae were present similar to that seen in the liver (Figure 6). Some



**Figure 5:** Liver, lamb: liver parenchyma is replaced by a blood filled cavities (migration tracts) and a cross section of a larval cestode H&E, x40.



**Figure 6:** Lung, lamb: a cavity containing cross sections of larval cestodes H&E, x20.

lesions were accompanied by infiltration of inflammatory cells, neutrophils macrophages and cell debris.

### Laboratory Results

According to their morphological characteristics the cysts were diagnosed as *Cysticercus tenuicollis*.

### DIAGNOSIS

A diagnosis of acute visceral cysticercosis by *Taenia hydatigena* was made based on the marked multifocal acute hemorrhage and hepatic necrosis and mild to moderate pneumonia due

to metazoan migration tracts, with the presence of a number of cestode larvae (9).

## DISCUSSION

Hepatitis cysticercosa and pneumonitis cysticercosa are caused by migrating *Cysticercus tenuicollis*, the intermediate stage of *Taenia hydatigena* (1). Sheep, goats, cattle and pigs are among the species that are considered as the intermediate hosts in which larval migratory stages causes damage during their migration through the liver and lungs (10).

The adults cestode *Taenia hydatigena* inhabits the gastrointestinal tract of carnivores, the final host, and does not usually cause clinical signs (7). Gravid segments are shed by the adult tapeworms into the environment and their eggs are immediately infective. Animals acquire infection from ingestion of food or water contaminated with the sticky eggs, ingesting of segments or feces containing eggs (10).

In the intermediate host, *Cysticercus tenuicollis*, migrates into the peritoneal cavity. Laval cestodes migrate into the liver and lung and may induce extensive damage if infection is heavy. Upon the ingestion of the ova by the intermediate host oncospheres are released and penetrate the wall of the gut and are then distributed via the blood to virtually any site in the body. Parasitic cysts continue to develop in the intermediate host and the life cycle of the parasite is completed when the cysts are ingested by the final host. The liver of the intermediate host is commonly affected through the flow of portal blood containing helminth embryos which drains into the liver before flowing to the systemic circulation.

These cases represent unusually severe infestations. In both cases, neither the affected flocks nor the herding dogs were properly dewormed and several stray dogs roamed in the vicinity of the farms. This situation is not considered unusual in this district of second case, and therefore it was believed that in addition to these predisposing factors, there was probably direct and intense contact and ingestion of infected dog feces in the food of the affected lambs and kids.

Both liver and lung involvement are commonly observed in the acute form of cysticercosis however a single case where only hepatic involvement has been observed is described in an outbreak from Iran (7).

Investigation of the incidents led to the possibility that the main source of infestation in both cases was food borne in the concentrated feed manufactured by a local dealer in

the first case and in the hay in the second case, respectively. This suspicion was reinforced by the fact that the outbreaks occurred over a few weeks with a high rate of mortality. It was proposed that the feed that the animals received, in both cases, was infested with proglotids of the tapeworm *Taenia hydatigena*

Adult sheep and goats from both herds were not affected. The evidence for age-related differences in infection prevalence and intensity is not clear. It has been found and documented that the prevalence of hydatidosis and cysticercosis in sheep is significantly lower in sheep up to 1 year of age compared to adult sheep (2, 11). The authors suggested that this may be associated with age and with the foraging activity of sheep (12). In the first case of the present study, the adult animals were also pastured and therefore may have consumed less infested concentrated food. In the second case, animals were only fed in paddocks. A more pragmatic approach for the infestation of the lambs in the first case may have been due to the feeding of a specific bag of food which was highly infested by proglotids from infested dogs from the premises of the food distributor.

In summary, this report describes two outbreaks of cysticercosis in herds of sheep and goats resulting in a high mortality among lambs and kids. Both the liver and lung were severely affected resulting in the death of the animals. Investigation of the source of infestation placed a strong suspicion on the concentrated food from a local producer in the one case and contaminated hay in the second case.

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