Islamic Azad University
Urmia Branch

Journal of Basic and Clinical Veterinary Medicine

2024; 5(1): 50-56

Official Journal of Veterinary Faculty of Islamic Azad University
Urmia Branch

Journal Homepage: https://sanad.iau.ir/journal/jbcvm/

Case Report

Acute visceral cysticercosis in lambs of Northern Iran

Nasrollah Vahedi Nouri [1*], Javad Abbasi Harazi [2], Alireza Salehi [3]

[1]*Razi Vaccine and Serum Research Institute, Agricultural Research, Education and Extension Organization (AREEO), Karaj, Iran*
[2]*Department of Parasitology, Shahid Bahonar University of Kerman, Kerman, Iran*
[3]*Department of Pathology, Faculty of Veterinary Medicine, Islamic Azad University, Babol Branch, Babol, Iran*

ARTICLE INFO

Received: 29 November 2023

Accepted: 21 January 2024

DOI:10.30495/jbcvm.2024.2002618.1057

KEYWORDS:

Visceral Cysticercosis
Lambs
Praziquantel
Northern Iran

ABSTRACT

Cysticercus tenuicollis is the larval stage of the tapeworm Taenia. It is a tapeworm that primarily infects dogs and other canids as its definitive hosts, and various ungulates (such as sheep, goats, and pigs) as intermediate hosts. The larval stage, *Cysticercus tenuicollis*, develops in the intermediate hosts. The present study examined the causes of death in 14 lamb flocks, which were infected with acute cysticercosis in Mazandaran Province. The causative agent was *Cysticercus tenuicollis*, the larval stage of the tapeworm *Taenia hydatigena*. This study examined instances of acute visceral cysticercosis in 14 lamb flocks located within Mazandaran Province. This parasitic infection was associated with mortality rates varying between 20% and 45% among the flocks, with a mean of 29%. A complete postmortem examination showed the presence of *Cysticercus tenuicollis* in internal organs such as the liver, lungs, heart, and diaphragm of lambs. Examination of the feces of herding dogs showed the presence of eggs and gravid proglottids consistent with those of *Taenia hydatigena*. Praziquantel was used for the treatment of both infected lambs and herding dogs. Based on our findings, it was concluded that the main source of infection was the infected stray dogs.

سیستی سرکوز احشایی حاد در بره های شمال ایران

نصرالله واحدی نوری [۱*]، جواد عباسی هرازی [۲]، علیرضا صالحی [۳]

[۱] *موسسه تحقیقات واکسن و سرم سازی رازی، تحقیقات کشاورزی، سازمان آموزش و ترویج، کرج، ایران*
[۲] *گروه انگل شناسی، دانشگاه شهید باهنر کرمان ، کرمان، ایران*
[۳] *گروه آسیب شناسی، دانشکده دامپزشکی، واحد بابل، دانشگاه آزاد اسلامی، بابل، ایران*

چکیده

سیستی سرکوس تنوئیکالیس مرحله لاروی کرم نواری تنیا است. تنیا کرم نواری بوده که عمدتاً سگ ها و سایر سگ سانان را به عنوان میزبان قطعی خود و حیوانات مختلف (مانند گوسفند، بز و خوک) را به عنوان میزبان میانی آلوده می کند. مرحله لاروی *سیستی سرکوس تنوئیکالیس*، در میزبان های میانی ایجاد می شود. این مطالعه به بررسی علل مرگ و میر ۱۴ گله بره استان مازندران که به سیستی سرکوزیس حاد مبتلا بودند، پرداخته است. عامل بیماری *سیستی سرکوس تنوئیکالیس*، مرحله لاروی کرم نواری *تنیا هیداتی ژنا* می باشد. این مطالعه به بررسی موارد سیستی سرکوز احشایی حاد در ۱۴ گله بره واقع در استان مازندران پرداخته است. این عفونت انگلی با میزان تلفات بین ۲۰ تا ۴۵ درصد در بین گله ها همراه بود. معاینه کامل پس از مرگ، وجود *سیستی سرکوس تنوئیکالیس* را در اندام های داخلی مانند کبد، ریه، قلب و دیافراگم بره ها نشان داد. بررسی مدفوع سگ‌های گله وجود تخم‌ها و پروگلوتیدهای حاملگی مطابق با مدفوع *تنیا هیداتی ژنا* را نشان داد. پرازیکوانتل برای درمان بره های آلوده و سگ های گله استفاده شد. بر اساس یافته‌های ما، به این نتیجه رسیدیم که منبع اصلی آلودگی، سگ‌های ولگرد آلوده بوده‌اند.

واژه های کلیدی: سیستی سرکوز احشایی، بره ها، پرازیکوانتل، شمال ایران

* Corresponding author: nsvahedi@yahoo.com

INTRODUCTION

Amol City is located in Northern Iran (Mazandaran Province), on the Caspian Sea's southern coast (Figure 1). This city has a temperate and humid climate, with nearly hot and humid summers on the shore. Winters in these areas are moderate and humid, with only a few frosty days. For these reasons, animal husbandry is one of the most prominent occupations in this area due to its geographical characteristics [1, 2]. However, despite a large number of small ruminants in Amol, the production rate is considered low for various reasons, including the existence of parasitic diseases [1, 2]. Among the common parasitic infections in small ruminants is *Cysticercus tenuicollis* [3]. *Cysticercus tenuicollis* is the larval stage of *Taenia hydatigena*, which is a canine tapeworm but also found in cats and wild canids [4]. Mature *cysticercus* is usually found on the omentum, mesentery, and peritoneum and, less frequently, on the pleura and pericardium. In addition, migrating larvae can be found mostly in the liver parenchyma, which can cause traumatic hepatitis in young animals [5]. Cysticercosis can manifest in either an acute or chronic form [6]. The chronic form is more common and usually asymptomatic and is generally diagnosed at the abattoir postmortem [7]. In Asian countries, this disease form sometimes leads to economic losses attributable to the removal of infected organs [8, 9]. The acute form of infection is rare in sheep, and reports of outbreaks of severe visceral cysticercosis in lambs are uncommon [10]. Only a few isolated cases of single lamb deaths have been documented in Asian countries [8, 11]. This study describes outbreaks of acute cysticercosis in lambs, which resulted in extensive mortality among herds in this area. Investigation of the source of infection led to a high suspicion of contamination of food fed to these animals. This research described the outbreak findings and epidemiological evaluations.

CASE PRESENTATION

In May 2022, a report was received about lamb deaths in 14 herds of sheep in Mazandaran Province, with an approximate age of 2 to 2.5 months. Animals were sent to the veterinary research department of the Agricultural and Natural Resources Research Center of Mazandaran Province. Death occurred about 15 days after they were transferred to their current pasture, which ended in a mortality rate from 20% to 45%, with a mean of 29%. At first, the lambs had symptoms such as abdominal pain, fever, lethargy, loss of appetite, and emaciation. Neither the sheep nor the herding dogs received any antiparasitic treatment. In addition, stray dogs were present in the region near the breeding area of sheep flocks (Table 1). After performing an autopsy on the carcasses of the lambs, the presence of a large number of white cysts on the liver, lungs, and other internal organs such as the heart and diaphragm drew attention. By further examining the cysts in the pathological laboratory, the presence of *Cysticercus tenuicollis* was confirmed. The liver was inflamed and contained hemorrhagic veins, which were caused by the migration of parasite larvae in the tissue's parenchyma (Figure 2). In addition, the lungs, liver, omentum, mesentery, and peritoneum were examined for the presence of *C. tenuicollis* and necrotic–hemorrhagic tracks of the migrating parasites at postmortem examination (Figure 3). The parasites in lambs were identified morphologically using well-established methods, consistent with prior reports [12]. Moreover, the feces of the herding dogs were tested parasitologically, and the eggs and excretion of gravid proglottids of this parasite were confirmed. Regarding the sampling in dogs, each sample was initially

checked macroscopically for the presence of adult worms and/or proglottids. Copromicroscopic examination was then carried out for each individual sample using sedimentation and flotation techniques with sodium thiosulfate solution in order to detect helminth eggs [13]. To treat infected lambs of the herds, a single dose of an antiparasitic drug named Praziquantel (STEROP 600 MG TAB) was administered [6]. Eventually, a significant improvement in the clinical signs of the infected lambs was observed after a week. In addition, Praziquantel was also used to treat herding dogs [14].

DISCUSSION

Taenia hydatigena lives in the digestive system of carnivores such as dogs and foxes, which are the final hosts, and usually does not cause clinical symptoms [6]. Gravid proglottids, containing the eggs, will move from the bottom of the worm. They leave the body in the feces, while their eggs can begin to infect [11]. Ruminants, which are intermediate hosts, will become infected by eating contaminated food or water with eggs or feces containing eggs [15]. The pathogenicity of adult parasites was not

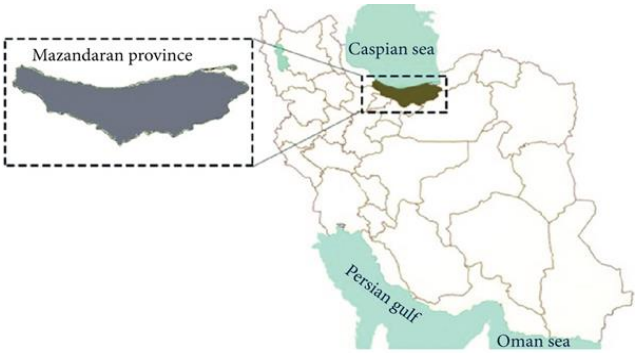

Figure 1: Location of Mazandaran province in the map of Iran.

Table 1: Comparison of different indices among all the herds.

Farm No	number of animals	number of lambs	%morbidity rate (Number)	% mortality rate (Number)	breed	type of farming	Clinical signs			
							abdominal pain	anorexia	Lethargy	weakness
1	145	47	75(35)	22(10)	Hybrid	extensive	+	+	+	+
2	135	44	80(35)	25(11)	Hybrid	extensive	+	+	+	+
3	131	40	80(32)	40(16)	Hybrid	extensive	+	+	+	+
4	127	37	70(26)	35(13)	Hybrid	extensive	+	+	+	+
5	117	36	75(26)	28(10)	Hybrid	extensive	+	+	+	+
6	111	32	75(24)	45(14)	Hybrid	extensive	+	+	+	+
7	102	28	65(18)	25(7)	Hybrid	extensive	+	+	+	+
8	97	27	67(18)	25(7)	Hybrid	extensive	+	+	+	+
9	95	25	80(20)	22(6)	Hybrid	extensive	+	+	+	+
10	92	23	70(16)	20(5)	Hybrid	extensive	+	+	+	+
11	88	25	65(16)	35(9)	Hybrid	extensive	+	+	+	+
12	87	15	75(11)	30(5)	Hybrid	extensive	+	+	+	+
13	73	14	70(10)	22(3)	Hybrid	extensive	+	+	+	+
14	65	14	70(10)	25(4)	Hybrid	extensive	+	+	+	+
Total	1465	407	73(297)	29(120)	-	-	-	-	-	-

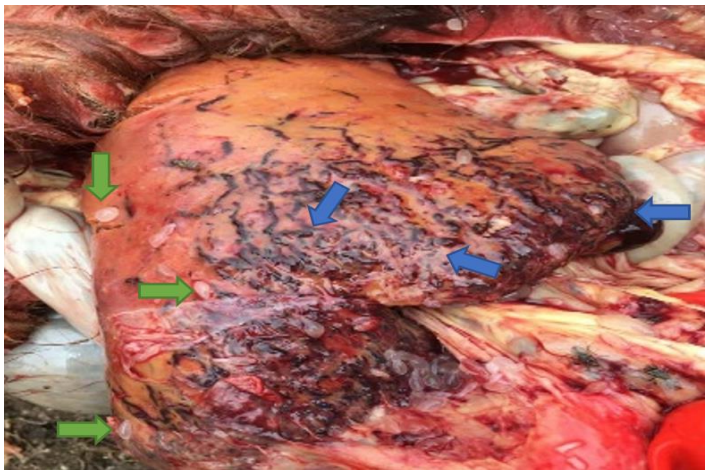

Figure 2: Inflamed liver showing multiple intraparenchymal hemorrhagic tracts (Blue arrow) and parasite cysts (Green arrow).

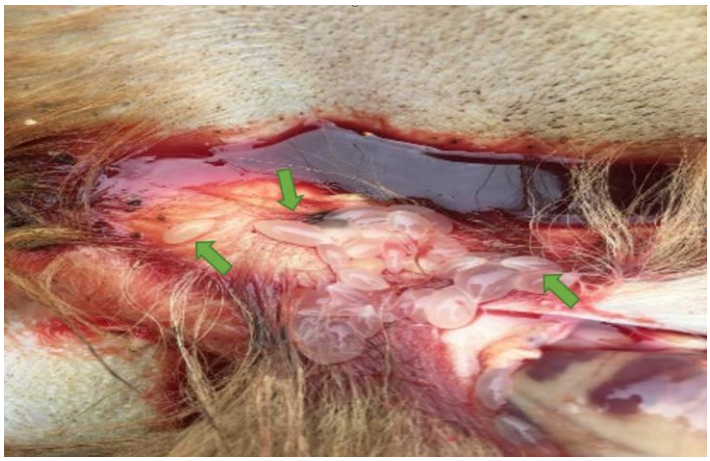

Figure 3: Closer view of cysticerci (Green arrow) in the peritoneum.

high for definitive hosts. However, large numbers of developing cysticerci migrate contemporaneously in the liver of intermediate hosts, producing hemorrhagic and fibrotic tracts known as "hepatitis cysticercosa," a condition whose gross pathology resembles acute fasciolosis, which is often fatal [16, 17]. This report demonstrated an outbreak of cysticercosis in sheep flocks, which resulted in a high mortality rate among lambs. These cases indicated an abnormally strong infestation. Liver and lung involvement are usually seen in the acute form of cysticercosis, and if the infection is severe, these tissues may experience a lot of damage and multiple lesions. As was similarly observed in Iran, a case with liver involvement was seen previously in an outbreak of *Taenia hydatigena* [11]. Specifically, both the liver and lungs were severely affected, leading to the death of the lambs. After an autopsy, an acute infection of cysticercosis was confirmed. Also, based on the results of other researchers about cysticercosis, similar observations have been reported [10, 11, 18]. Scala et al. (2016) showed that 5 out of 21 (23.8%) lambs in a herd were infected with the larval stage of acute cysticercosis [6]. The research of Koutsoumpas et al. (2013) showed that out of 42 slaughtered lambs from a herd with symptoms of lethargy and depression, 20 had acute liver lesions caused by cysticercosis [10]. By examining the liver and lungs of a four-month-old female lamb that died in Shahrekord, they noticed widespread infection with *Taenia hydatigena* larvae throughout the liver. Large brown to red areas of hemorrhage also appeared on the edges of the liver. All *T. hydatigena* larvae present in the migration

canals and liver surfaces were immature. There were no mature cysts. Histopathological examinations of the liver showed numerous sections of migration canals that were filled with red blood cells, fibrin, and tissue debris. Additionally, degeneration of liver cells, necrosis, fat change, and infiltration of mixed inflammatory cells including lymphocytes, plasma cells, and macrophages were observed [11]. In summary, the main causative reason for this outbreak was the herds and infected stray dogs with the adult form of *Taenia hydatigena*. Considering that the outbreak occurred 20 days after the lambs were moved to pasture, it can be said that this outbreak was preventable. Our findings are also consistent with an earlier study that was conducted on goats [19]. The results were backed up by examining the observation of herding dogs. Therefore, it is possible that there was direct severe contact between sheep and dogs, and the ingestion of infected dog feces in the food of the affected lambs played a critical role. According to the investigations, neither the sheep flocks nor the studied herd dogs have been pretreated against parasites with any antiparasitic agent. On the one hand, clinical evidence suggested that adult sheep were not affected by the disease. On the other hand, researchers previously showed that the prevalence of cysticercosis in sheep can occur up to the age of one year, which was significantly lower than that of adult sheep [7, 20]. Mortality of 20% to 45%, with a mean of 29%, of lambs in addition to the obvious losses emphasizes the importance of keeping stray dogs away from sheep herds and pastures. Additionally, regular antiparasitic treatment of dogs, especially before releasing the lambs into the pasture, is an important step. An earlier study examined the slaughterhouses in the Sardinia region of Italy, which showed that the rate of cysticercosis prevalence in lambs was 14.6%. The observational techniques suggested 8.3% of dog feces contamination, while the ATH4 monoclonal antibody ELISA method showed a prevalence of 11% for *Taenia hydatigena* in dogs. Furthermore, 30-40 days old lambs showed the maximum number of parasites [21]. Although multiple attempts have been made to diagnose cysticercosis by serological tests or ultrasonographic examination before animal death [22, 23], the final diagnosis of the disease is only made by analyzing the cysts after slaughtering the animal [24].

Generally, Mazandaran is an endemic area for *Taenia hydatigena*, so sheep are more likely to contact any infected surface. This is a concern because cysts can easily develop in lambs whose immature immune systems cannot hold the line with the parasites [25]. In this condition, cysticercosis can occur with a high probability. Regarding the treatment of sheep with praziquantel, it is worth mentioning that this drug has been widely used for the treatment of cysticercosis in humans, which can be caused by accidental consumption of *Taenia solium* eggs [26]. Praziquantel is easily absorbed and rapidly distributed throughout the parenchyma of various tissues, which explains its efficacy in parenchymal infections [27]. In the present study, the administration of praziquantel reduced the clinical signs and resulted in the survival of most of the lambs with acute infection. This result was in line with a previous study conducted by Skala et al. in 2016, which showed that the administration of praziquantel in lambs suffering from cysticercosis with a single dose of 15 mg/kg of body weight could cause a significant improvement in the clinical condition and biochemical parameters up to 30 days after the treatment [6]. Although no tissue samples were taken from the lambs after treatment to assess the true efficacy of the drug, the clear improvement in the clinical condition of the animals indicated that praziquantel could

control the infection and allow full recovery of the affected lambs.

ETHICS

Approved.

CONFLICT OF INTEREST

All authors disclose any financial and personal relationships with other people or organizations that could inappropriately influence this research.

REFERENCES

[1] Salehi A, Razavi M, Vahedi Nouri N. Seasonal prevalence of helminthic infections in the gastrointestinal tract of sheep in Mazandaran province, Northern Iran. Journal of Parasitology Research. 2022; eCollection 2022. **doi:10.1155/2022/7392801**

[2] Nouri NV, Rahmatian R, Salehi A. Prevalence of helminthic infections in the gastrointestinal tract of cattle in Mazandaran province (Northern Iran). Journal of Parasitology Research. 2022; eCollection 2022. **doi:10.1155/2022/7424647**

[3] Khanjari A, Cheraghi N, Bokaie S, Fallah S, Basti AA, Fallah M, et al. Prevalence of Cysticercus tenuicollis in slaughtered sheep and goats by season, sex, age, and infected organ at Amol abattoir, Mazandaran province, Iran. Comparative Clinical Pathology. 2015; 24(1): 149-52.

[4] Taylor MA, Coop RL, Wall RL. Veterinary parasitology: John Wiley & Sons; 2015.

[5] Blazek K, Schramlova J, Hulinska D. Pathology of the migration phase of Taenia hydatigena (Pallas, 1766) larvae. Folia Parasitol. 1985; 32(2): 127-37.

[6] Scala A, Urrai G, Varcasia A, Nicolussi P, Mulas M, Goddi L, et al. Acute visceral cysticercosis by *Taenia hydatigena* in lambs and treatment with praziquantel. Journal of helminthology. 2016; 90(1): 113-6. **doi:10.1017/S0022149X14000601**

[7] Christodoulopoulos G, Theodoropoulos G, Petrakos G. Epidemiological survey of cestode-larva disease in Greek sheep flocks. Veterinary parasitology. 2008; 153(3-4): 368-73. **doi:10.1016/j.vetpar.2008.02.002**

[8] Radfar MH, Tajalli S, Jalalzadeh M. Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena cysticerci*) from sheep and goats in Iran. Veterinarski arhiv. 2005; 75(6): 469.

[9] Singh B, Sharma R, Gill J, Sharma J. Prevalence and morphological characterisation of *Cysticercus tenuicollis* (*Taenia hydatigena* cysts) in sheep and goat from north India. Journal of Parasitic Diseases. 2015; 39: 80-4. **doi:10.1007/s12639-013-0284-7**

[10] Koutsoumpas A, Psychas V, Papadopoulos E, Panousis N, Karatzias H, Giadinis N. Acute visceral cysticercosis in feed-lot lambs. Revue De Medecine Veterinaire. 2013; 164(8/9): 425-8.

[11] Nourani H, Pirali Kheirabadi K, Rajabi H, Banitalebi A. Research note an unusual migration of Taenia hydatigena larval in a lamb. Tropical Biomedicine. 2010; 27(3): 651-6.

[12] Rostami S, Salavati R, Beech R, Babaei Z, Sharbatkhori M, Baneshi M, et al. Molecular and morphological characterization of the tapeworm *Taenia hydatigena* (Pallas, 1766) in sheep from Iran. Journal of Helminthology. 2015; 89(2): 150-7. **doi:10.1017/S0022149X13000667**

[13] Varcasia A, Garippa G, Scala A. The diagnosis of *Echinococcus granulosus* in dogs. Parassitologia. 2004; 46(4): 409-12.

[14] Gemmell M, Johnstone P, Oudemans G. The effect of praziquantel on *Echinococcus granulosus*, *Taenia hydatigena* and *Taenia ovis* infections in dogs. Research in Veterinary Science. 1977; 23(1): 121-3.

[15] Hajipour N, Tavassoli M. Prevalence and associated risk factors of *Linguatula serrata* infection in definitive and intermediate hosts in Iran and other countries: a systematic review. Veterinary Parasitology: Regional Studies and Reports. 2019; 16: 100288. **doi:10.1016/j.vprsr.2019.100288**

[16] Kara M, Doğanay A. Investigation of antigenic specificity against *Cysticercus tenuicollis* cyst fluid antigen in dogs experimentally infected with Taenia

hydatigena. Turkish Journal of Veterinary & Animal Sciences. 2005; 29(3): 835-40.

[17] Soulsby EJL. Helminths, arthropods and protozoa of domesticated animals. Helminths, arthropods and protozoa of domesticated animals. 1968.

[18] Livesey C, Herbert I, Willis J, Evans W. Acute cysticercosis in housed sheep. The Veterinary record. 1981; 109(11): 217. **doi:10.1136/vr.109.11.217**

[19] Pathak K, Gaur S, Sharma S. The pathology of *Cysticercus tenuicollis* infection in goats. Veterinary parasitology. 1982; 11(2-3): 131-9. **doi:10.1016/0304-4017(82)90035-8**

[20] Sotiraki S, Himonas C, Korkoliakou P. Hydatidosis–echinococcosis in Greece. Acta tropica. 2003; 85(2): 197-201. **doi:10.1016/S0001-706X(02)00273-5**

[21] Scala A, Pipia AP, Dore F, Sanna G, Tamponi C, Marrosu R, et al. Epidemiological updates and economic losses due to *Taenia hydatigena* in sheep from Sardinia, Italy. Parasitology Research. 2015; 114: 3137-43. **doi:10.1007/s00436-015-4532-x**

[22] Panda M, Ghosh S, Rawat P, Singh N, Gupta M, Varma T. Diagnosis of Cysticercus tenuicollis in sheep and goat by indirect ELISA employing oncosphere antigen. Indian Journal of Animal Sciences. 2004; 74(9): 911-14.

[23] Corda A, Dessì G, Varcasia A, Carta S, Tamponi C, Sedda G, et al. Acute visceral cysticercosis caused by *Taenia hydatigena* in lambs: ultrasonographic findings. Parasites & Vectors. 2020; 13: 1-7. **doi:10.1186/s13071-020-04439-x**

[24] Athar H, Mir AQ, Gugjoo MB, Ahmad RA, Khan HM. Ultrasonography: An affordable diagnostic tool for precisely locating Coenurosis cyst in sheep and goats. Small Ruminant Research. 2018; 169: 19-23. **doi:10.1016/j.smallrumres.2018.10.002**

[25] Gemmell M, Lawson J, Roberts M, Griffin J. Population dynamics in echinococcosis and cysticercosis: regulation of *Taenia hydatigena* and *T. ovis* in lambs through passively transferred immunity. Parasitology. 1990; 101(1): 145-51. **doi:10.1017/S0031182000079853**

[26] García HH, Evans CA, Nash TE, Takayanagui OM, White Jr AC, Botero D, et al. Current consensus guidelines for treatment of neurocysticercosis. Clinical Microbiology Reviews. 2002; 15(4): 747-56. **doi:10.1128/CMR.15.4.747-756.2002**

[27] Adams HR. Veterinary pharmacology and therapeutics: Iowa state university press; 2001.