

A report on *Coenurus cerebralis* infection in a wild goat (*Capra aegagrus*)

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Article Info	Abstract
<p>Article history:</p> <p>Received: 11 August 2018 Accepted: 14 October 2018 Available online: 15 March 2019</p> <p>Key words:</p> <p><i>Coenurus cerebralis</i> <i>Taenia multiceps</i> Wild goat</p>	<p><i>Coenurus cerebralis</i> is the larval stage of <i>Taenia multiceps</i> inhabiting the small intestine of dogs and wild carnivores as the definitive hosts. A two-year-old wild female goat (<i>Capra aegagrus</i>) was referred with signs of lateral recumbency and seizure for four days and loss of appetite. In clinical examination, paddling, convulsion, and unconsciousness were observed indicating central nervous system disorder. Biochemical analyses showed increased levels of hematocrit, creatinine phosphorous, total bilirubin, direct bilirubin, blood urea nitrogen and calcium. No bacteria has been grown on culture medium taken from cerebrospinal fluid (CSF). The amount of total protein of the CSF was 1.10 g dL⁻¹ (normal range = 20 - 40 mg dL⁻¹). Hematological changes represented a left shift degenerative leukocytosis. At necropsy, two cysts sized over the 3 × 3 cm were detected, one on occipital lobe of the right hemisphere and the other on superior colliculi. The cysts contained a translucent fluid with a number of clusters of scolices growing from the inner layer of the cysts. To the best of our knowledge, this is the first report of coenurosis occurrence in <i>Capra aegagrus</i>.</p>

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آلودگی با سنوروس سربرالیس در یک رأس بز وحشی (*Capra aegagrus*)

چکیده

سنوروس سربرالیس، مرحله لاروی تنیا مولتی سپیس است که در روده کوچک سگ ها و گوشتخواران وحشی به عنوان میزبان قطعی زندگی می کند. یک رأس بز وحشی (*Capra aegagrus*) ماده دوساله با علائم از پا افتادگی جانبی و تشنج به مدت چهار روز و از دست رفتن اشتها مورد پذیرش قرار گرفت. در معاینه بالینی، دست و پا زدن، تشنج و عدم هوشیاری مشاهده شد که نشان دهنده اختلال دستگاه عصبی مرکزی بود. ارزیابی های بیوشیمیایی افزایش سطوح هماتوکریت، کراتینین فسفات، بیلی روبین تام، بیلی روبین مستقیم، نیترا ت اوره خون و کلسیم را نشان داد. هیچ باکتری بر روی محیط کشت تهیه شده از مایع مغزی نخاعی رشد نکرده بود. میزان پروتئین تام مایع مغزی نخاعی ۱/۱۰ گرم بر دسی لیتر (میزان طبیعی = ۲۰-۴۰ میلی گرم بر دسی لیتر) بود. تغییرات خون شناسی نشان دهنده لکوسیتوز همراه با انحراف به چپ دژنراتیو بود. در کالبد گشایی، دو کیست با اندازه بزرگتر از ۳×۳ سانتی متر، یکی روی لب پس سری نمیکره راست و دیگری روی برجستگی چهارگانه مشاهده شد. کیست ها حاوی مایع شفاف با تعدادی از دسته های اسکولکس رشد یافته از لایه داخلی کیست ها بود. براساس اطلاعات نویسندگان، این گزارش نخستین گزارش وقوع سنوروز در این گونه می باشد.

واژه های کلیدی: بز وحشی، تنیا مولتی سپیس، سنوروس سربرالیس

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Introduction

Coenurus cerebralis is the larval stage of *Taenia multiceps* inhabiting the small intestine of dogs and wild carnivores as the definitive hosts.¹ The disease is known as gid or sturdy which mainly occurs in the central nervous system (CNS) of sheep and goats and to a lesser extent in other animals (e.g., cattle, buffalo, camel, pig, deer, horse, yak, wild sheep), and humans.^{1,2} This disease causes a major health problem mainly in sheep and goats worldwide and may have significant economic outcomes.³ Symptoms depend on the location and size of the cysts and also the degree of brain compression.³ *Coenurus cerebralis* causes purulent meningoencephalitis and when the cyst grows, it leads to CNS disorders which could lead to death. Infected animals show ataxia, blindness, circling, convulsion, teeth grinding, head tilt, incoordination, uncontrolled movements, salivation, paresis and cerebral atrophy. Most of the typical clinical findings have been observed 2-8 months after the pathogen ingestion.³ The *Coenurus* cysts have also been reported in extra-cranial locations in goats like peritoneal and pelvic cavities, liver, intramuscular, tongue, parotid, lung, perineal fat, tunica adventitia of the aorta and lungs.^{4,5}

Coenurosis is usually diagnosed based on a clinical examination and rarely with imaging methods (i.e. radiology, ultrasonography, and computed tomography). Immunodiagnostic tests like skin test for immediate hypersensitivity and indirect hemagglutination antibody, immune-electrophoresis, gel double diffusion, immunoblot and enzyme-linked immune-assay have been used experimentally.⁶ Overall, diagnosis is generally confirmed through a necropsy.³ In this report, we described an occurrence of coenurosis in a wild goat (*Capra aegagrus*).

Case Description

A two-year-old wild female goat was referred to the Veterinary Research and Teaching Hospital of University of Tehran, Iran with the signs of lateral recumbency and seizure for 4 days and loss of appetite. Based on owner declaration, the case was a wild goat and its morphological features were matched to *C. aegagrus*, one of the nine species of wild goats in the world. This kind of wild goat is observed in the most ranges area in Iran. Dispersion or density of *C. aegagrus* is in Asia Minor, Middle East, Europe and middle Asia.⁷

In clinical examination, paddling, convulsion, and unconsciousness were observed indicating CNS disorder. Convulsion episodes were associated with opisthotonus, orthotonus, paddling and oral foaming every 4-5 min. There were tachycardia (170 beats per min), tachypnea (80 breaths per min) and mild hyperthermia (40 °C). Furthermore, the blood sample (from the jugular vein, 10.00 mL) and 2.00 mL cerebrospinal fluid (CSF)

from atlanto-occipital joint, were taken for further examinations. Conjunctival hyperemia and keratitis were evident, whereas no menace reflex was recorded. Finally, the animal died due to severe signs and then, necropsy was performed.

Results

Biochemical analyses showed an increased level of packed cell volume (PCV), creatinine phosphorous, total bilirubin, direct bilirubin, blood urea nitrogen (BUN), and calcium. No bacteria had been grown on culture medium taken from CSF. The amount of total protein of CSF was 1.10 g dL⁻¹ (normal range = 20.00 – 40.00 mg dL⁻¹). Hematological changes represented a left shift degenerative leukocytosis (Table 1).

Table 1. Biochemical and hematological characteristics of the wild goat comparing with the normal values.⁷

Parameter	Normal range	Wild goat
Biochemistry		
Phosphorous (mg dL ⁻¹)	9.75	10.31
Calcium (mg dL ⁻¹)	4.35	8.74
Magnesium (mg dL ⁻¹)	2.84	2.82
Potassium (mg dL ⁻¹)	3.50 - 6.70	4.60
Total bilirubin (mg dL ⁻¹)	0.44	2.12
Direct bilirubin (mg dL ⁻¹)	0.08	0.10
Creatinine (mg dL ⁻¹)	1.82	2.26
BUN (mg dL ⁻¹)	23.80	136.00
Hematology		
PCV (%)	26.10 ± 4.50	32.20
Hb (g dL ⁻¹)	8.50 ± 1.30	7.50
RBC (10 ⁶ dL ⁻¹)	12.20 ± 2.20	16.00
MCV (fl)	21.80 ± 3.70	20.00
MCHC (g dL ⁻¹)	33.00 ± 4.00	31.30
MCH (pg)	8.40 ± 1.60	11.00
Plasma protein (g dL ⁻¹)	6.40 - 7.00	5.70
Fibrinogen (mg dL ⁻¹)	0.10 - 0.40	0.20
WBC (10 ³ µL ⁻¹)	8.08 ± 2.51	13.40
Band neutrophil (%)	0.00	2.00
Segmented neutrophil (%)	49.00 ± 10.70	62.00
Lymphocyte (%)	42.30 ± 10.40	36.00

At necropsy, two cysts sized over the 3 × 3 cm were detected in two parts of the brain, one on occipital lobe of the right hemisphere and the other one on superior colliculi. The cysts contained a translucent fluid with a large number of scolices growing from the inner layer of the cysts. The outer layer of the cysts had a thick fibrotic capsule and the inner layer was characterized by a thin transparent wall. The parenchyma near the cysts was thinned and cerebral gyri nearby the superficial compartment of cysts were flattened and pressure atrophy occurred. In addition, hydatid cysts were detected in liver and lung.

Histopathological evaluation revealed compressive atrophy in the cerebral tissue adjacent to the wall of the cyst. Around the cyst, neuronal degeneration, diffuse

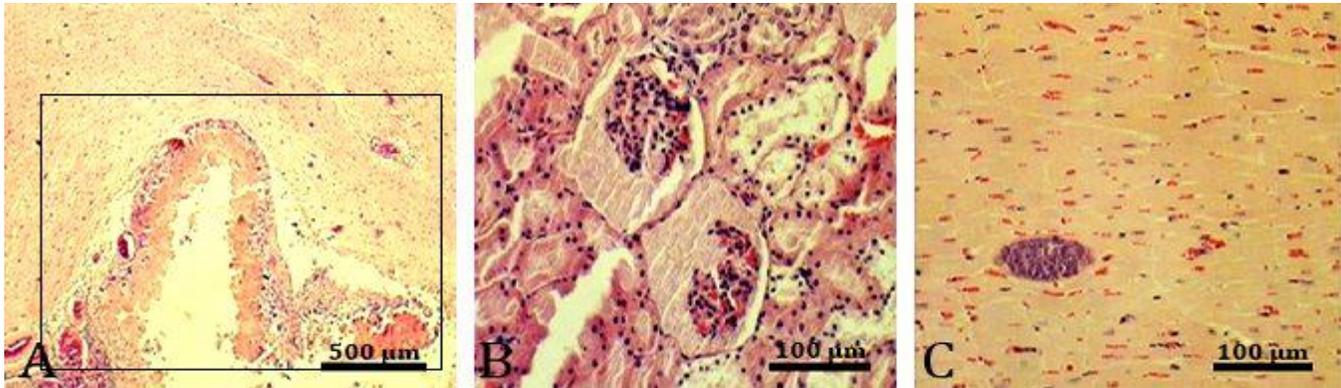


Fig. 1. A) Cyst of *Coenurus cerebralis* located in cerebrum (rectangle) and severe vascular hyperemia; **B)** Acute tubular necrosis and pyknotic and karyolytic nuclei; **C):** *Sarcocystis* in the myocardium (H & E staining).

astrocytosis, neuronophagia, microgliosis, demyelination, perivascular mononuclear cell infiltration, and hyperemia were observed. Further, hyperemia and perivascular lymphocytic infiltrations of the meninges overlying the cerebral tissue were also detected (Fig. 1A). Other findings were an acute tubular necrosis (Fig. 1B) and sarcocystosis in kidney and myocardium, respectively (Fig. 1C).

Discussion

Coenurosis is a significant problem in sheep and goats across the world. In Iran, coenurosis has been reported in goat⁴ and sheep.⁸ The incidence rate of this disease is 0.09 to 18.65% in different areas of Iran.⁵

Various clinical signs including ataxia, blindness, circling, incoordination, drowsiness, head pressing, hind leg paralysis, and coma have been indicated in other studies and were also observed in the present case.⁹

Anorexia for past days and dehydration resulted in increased PCV and hypoproteinemia. The decrease in blood volume and subsequent insufficient perfusion to kidney lead to waste products such as creatinine and phosphorous retention and enhanced BUN causing acute tubular necrosis. The CSF examination showed no inflammatory reaction. In microscopic evaluations, the distraction of neural tissue adjacent to the wall of the cyst, neuronal degeneration, diffuse astrocytosis, neuronophagia, microgliosis, demyelination, perivascular mononuclear cell infiltration, and hyperemia were observed which was in accordance with previous studies.^{10,11} We didn't observe eosinophilia around the cysts, this may be due to the later infiltration of eosinophils compared to lymphocytes.¹²

There is some evidence showed that the coenurosis prevalence in goats is less than sheep. This may be due to the less exposure of goats compared to sheep to the soil during grazing. Since goats usually eat leaves on top of the shrub and tree branches and also eat more specific than sheep. In addition, sheep are well-intermediated hosts for *T. multiceps* and coenurosis development.¹³

In coenurosis, cysts are often found in the CNS. It has been formerly shown that 96.00% of the CNS cysts are in the left or right cerebral hemisphere and 4.00% are in the cerebellum.¹⁴ Reportedly, the presence of coenurus was confirmed in the brain of wild goat and wild sheep at necropsy in Iran.¹³ In the current report, one of the cysts was on occipital lobe of the right hemisphere and another was on the superior colliculi. Cysts as space-occupying masses intervene with CSF absorption and can lead to increased intracranial pressure. Clinical signs are different based on site, size and amount of pressure in cerebral tissue. Affected animals are almost with no clinical signs and the cyst usually will discover after death or slaughtering incidentally.¹⁵

To conclude, we reported the occurrence of *C. cerebralis* in a wild goat. So, further investigations are desirable to identify the *Taenia* species in caprine coenurosis definitely.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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