NOTE *Pathology*

Coenurus cerebralis Cysts in the Left Lateral Cerebral Ventricle of a Ewe

Mohie HARIDY[1,2)]*, Hiroki SAKAI[2)], El-Shayma EL-NAHASS[2,3)], Ahmed EL-MORSEY[2,4)], Shehata ANWAR[2,3)] and Tokuma YANAI[2)]

[1)]*Department of Pathology and Clinical Pathology, Faculty of Veterinary Medicine, South Valley University, Qena 83523, Egypt*
[2)]*Department of Pathogenetic Veterinary Sciences, United Graduate School of Veterinary Sciences, Gifu University, 1–1 Yanagido, Gifu 501–1193, Japan*
[3)]*Department of Pathology, Faculty of Veterinary Medicine, Beni-Seuf Uinversity, Beni-Suef 62511, Egypt*
[4)]*Department of Parasitology and Animal Diseases, Division of Veterinary Research, National Research Center, Dokki, Giza 12622, Egypt*

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ABSTRACT. A three-and-a-half year-old female Rahmani ewe was presented suffering from nervous symptoms. Grossly, a large cyst measuring 7 × 4 cm and weighing 145 g occupied the dilated left lateral ventricle. The overlying cerebral tissue was thin, atrophied and congested. It tore easily, and the cyst was evacuated spontaneously. Microscopically, liquefactive necrosis surrounded by aggregations of macrophages, eosinophils, lymphocytes, fibroblasts and giant cells was predominantly observed. Hyperplasia and severe necrosis of the ependymal cell lining of the lateral ventricle were observed. Extensive subependymal inflammatory cell infiltrations, accompanied by neovascularization and fibroblastic proliferation, were seen. Based on the gross and histopathological lesions and cyst morphology and location, the cyst was diagnosed as *Coenurus cerebralis*. This report describes a rare case of coenurus cyst in the left lateral cerebral ventricle of a ewe and the associated lesion.

KEY WORDS: cerebral, *Coenurus*, cyst, ewe, ventricle.

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Coenurosis caused by *Coenurus cerebralis*, a bladder worm stage of *Taenia multiceps*, is a common parasitic disease of sheep and goats in the Afro-Asian region and constitutes a major health problem in sheep and goats worldwide [14].

Coenurus cysts are located in the cerebral hemispheres in 88–96% (almost equally distributed in the left and right hemispheres) and in the cerebellum in 4–12% of infected sheep [1]. Cysts may be present elsewhere in the brain and spinal cord, protruding into the cerebral ventricles, but they are often found near the surface of the parietal cerebral cortex [2]. The predilection sites of *C. cerebralis* cysts in the cerebral hemispheres of sheep, especially the subarachnoid space, facilitate the nourishment of the cyst by cerebrospinal fluid [3]. In contrast, bovine cerebral *Coenurosis* is very rare, and the lateral ventricles seem to be the preferred site for cysts localization [4, 6, 16]. Given that there have been few reports to date describing localization of *Coenurus* cysts in the cerebral ventricles of sheep; this study presents clinical and pathological findings in a rare case of *C. cerebralis* in the left lateral ventricle.

A three-and-a-half year-old female Rahmani ewe was admitted to the Clinic of Surgery; Faculty of Veterinary Medicine, South Valley University in May 2011, suffering from nervous symptoms that included loss of appetite, frequent bleating, dullness, torticollis, head inclination to the right, ataxia, irregular gait, sometimes walking in a straight line, circling and pressing the head against obstacles. Euthanasia of the affected ewe was carried out using an overdose of barbiturate, and a routine necropsy was performed. Brain specimens were fixed in 10% neutral buffered formalin and embedded in paraffin by routine methods. Sections, 4 μm in thickness, were stained with hematoxylin and eosin (HE).

Grossly, a large cyst measuring 7 × 4 cm and weighing 145 g occupied the dilated left lateral ventricle. The cyst contained a translucent fluid and a large number of white clusters of scolices budding from the internal layer of the cyst. The overlying cerebral tissue was thin, atrophied and congested. It tore easily, and the cyst was evacuated spontaneously (Fig. 1a). The cyst was as large in size as half of the brain. A secondary smaller cyst measuring 2 × 1.5 cm in diameter may have been connected to the large one, leaving a cavity in the cerebral tissue (Fig. 1b). White clusters of numerous rice-shaped scolices were attached to the germinal layer of the cyst. Interestingly, *Oestrus ovis* larvae were observed in the frontal sinuses with congestion of the nasal cavity.

Histopathological findings revealed an extensive area of liquefactive necrosis in the cerebrum (Fig. 2a) related to the evacuated *Coenurus* cyst. The necrotic foci were surrounded by macrophages, eosinophils, lymphocytes, fibroblasts and giant cells (Fig. 2b). Numerous chronic abscesses with frequent calcification were observed in the left hemisphere. The wall was formed of a thick layer of fibrous tissue with numerous blood vessels surrounded by mononuclear lymphocytes and eosinophils. The malacia revealed extensive infiltration of polymorph nuclear cells with neuropil destruction, leav-

*CORRESPONDENCE TO: HARIDY, M., Department of Pathogenetic Veterinary Sciences, United Graduate School of Veterinary Sciences, Gifu University, 1–1 Yanagido, Gifu 501–1193, Japan.
e-mail: mohieharidy@svu.edu.eg

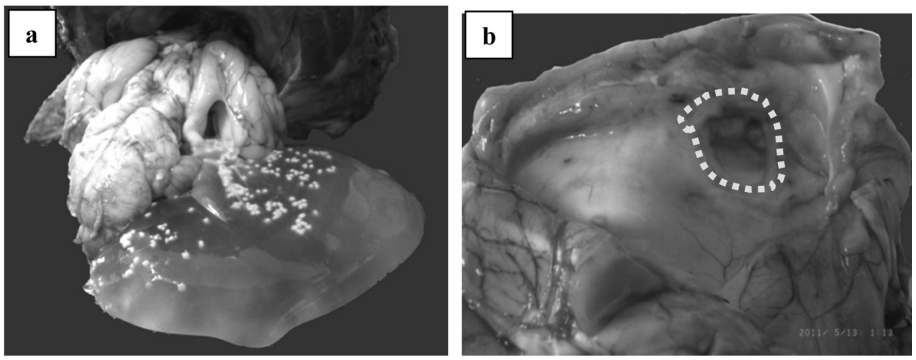

Fig. 1. Photographs from the dissected cranium of a ewe demonstrated (a) a large *Coenurus* cyst evacuated from the left lateral ventricle through a weak point of the cerebral hemisphere; the cyst contained many scolices and was almost half the size of the brain; (b) dilatation of the left ventricle with pressure atrophy of the surrounding cerebral tissue. A small cyst (yellow dotted line) measuring 2 × 1.5 × 1 cm in diameter was connected with the large cyst and left a cavity in the cerebral tissue.

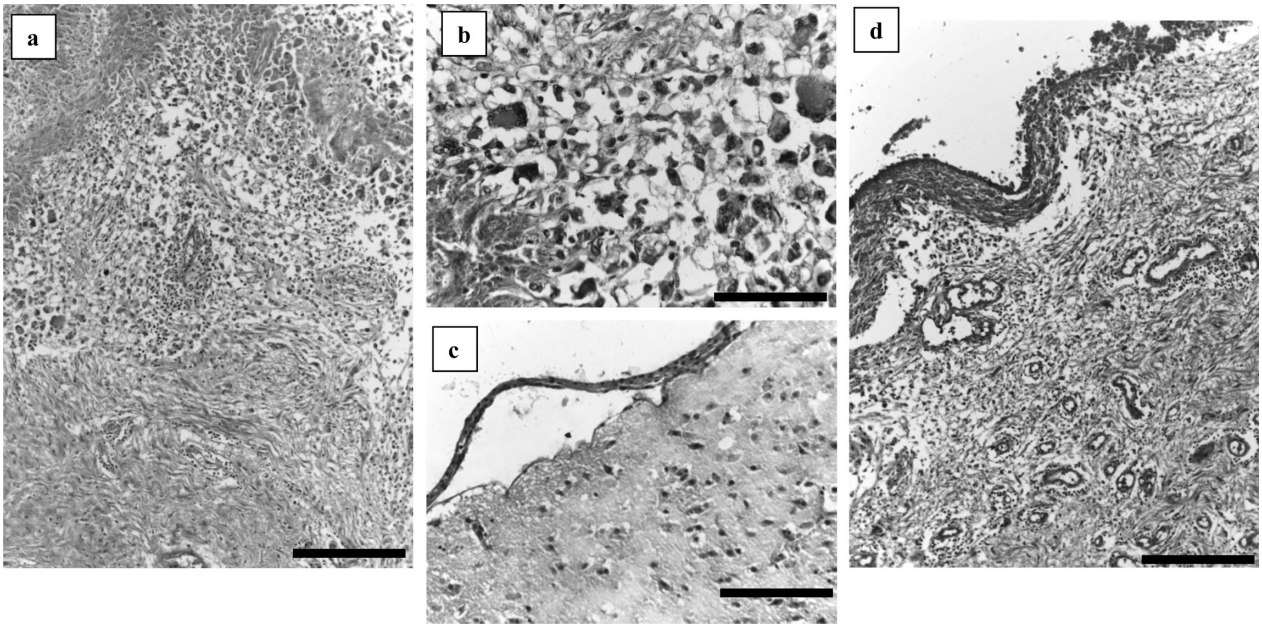

Fig. 2. Photomicrographs of cerebral tissues related to the *Coenurus* cyst revealed (a) liquefactive necrosis surrounded by inflammatory cell infiltrations, including (b) macrophages, lymphocytes, fibroblasts and giant cells; (c) hyperplasia of ependymal cells, (d) ependymal necrosis and subependymal inflammatory cell infiltration accompanied by neovascularization, fibroplasia of the neuropil and perivascular mononuclear cell infiltration. HE. Bar, 160 μm (a, d) and 40 μm (b, c).

ing blood vessels. Desquamation and degeneration of the ependymal cells of the left ventricular wall were prominent. Moreover, hyperplasia of the ependymal cell lining of the lateral ventricle was observed with microgliosis and neuronal degeneration of the subependymal cerebral tissue (Fig. 2c). Severe ependymal necrosis with extensive inflammatory cell infiltration accompanied by neovascularization and fibroblast cell proliferation in the neuropil was predominantly seen (Fig. 2d). The newly-formed blood vessels were surrounded by an extensive collar of mononuclear cells. Focal areas of cerebral hemorrhages were accompanied by neuronal degeneration. The meninges overlying the cerebral tissue revealed hyperemia and perivascular lymphocytic infiltration.

Fresh unstained samples of the internal fluid of the cyst revealed the rose thorn protoscoleces typical of *Taenia multiceps*. The scolices had four suckers and one rostellum armed with a double crown of around 25–30 hooks with hooklets. The hooks and hooklets were 175 and 119 μm in length, respectively, and the suckers were 325 μm each in diameter. Histologically, the cyst was composed of a single capsule composed of a thick wall with a dense outer

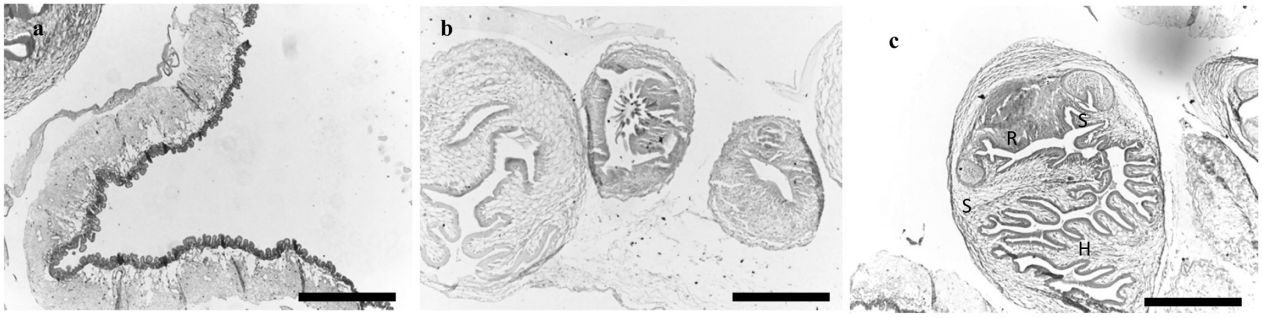

Fig. 3. Photomicrographs of the coenurus cyst revealed (a) a single capsule composed of a thick wall with a dense outer eosinophilic layer and an areolar, disorganized inner layer. (b) The wall of the cyst was continuous with multiple invaginated protoscolices. (c) The protoscolices were characterized by a prominent scolex with one rostellum (R), refractile rostellar hooklets (H) and four suckers (S), HE. Bar, 160 μm.

eosinophilic layer and an areolar, disorganized inner layer (Fig. 3a). The wall of the cyst was continuous with multiple invaginated protoscolices (Fig. 3b). The protoscolices were characterized by a prominent scolex with refractile hooklets and suckers (Fig. 3c).

Coenurus cysts are located mainly in the brain and spinal cord. In sheep, the cysts were found in the cerebral hemisphere in 96% of the affected cases (43% in the left hemisphere and 57% in the right) with the remaining 4% presented in the cerebellum [1]. There have been a small number of reports of definitive localization of coenuri in tissues of the brain in sheep and cattle. In cattle, cysts were localized in the temporo-parietal lobe (28.5%), occipital lobe (23.3%), frontal lobe (19%), cerebellum (14.3%), cerebrospinal lobe (9.5%) and spinal cord (4.9%) [9]. Similar localization was reported in goats [10]. The predilection sites of 299 *Coenurus* lesions in 120 symptomatic Sardinia sheep were as follows: cortex (241; 80.6%), cerebellum (22; 7.3%) and thalamus (17; 5.7%). In the cortex, the lesions were mainly in the middle part (126, 52.3%), followed by the frontal (63; 26.1%) and occipital parts (52; 21, 6%) [13]. The cysts were observed in other brain regions in sporadic cases (19; 6.4%), including the obex (2), medulla oblongata (4), mesencephalon (5), basal nucleus (6) and spinal cord (2) [13]. Epstein *et al.* [3] suggested that *Coenurus* cysts develop through the pathway of the cerebrospinal fluid. In human coenurosis, the cerebrospinal fluid pathway is often involved that incriminated in causing arachnoiditis and ependymitis [8]. Most of the reported coenurus cysts in sheep are related to the subarachnoid space and brain parenchyma [13]. To the authors' knowledge, very few cases of localization of *Coenurus* cysts in the lateral ventricles in sheep have been recorded. On the other hand, although coenurosis is uncommon in cattle, there have been several reports of cases involving ventricular cysts [4, 6, 16].

In the present study, an extensive area of cerebral liquefactive necrosis correlating to the evacuated *Coenurus* cyst was surrounded by macrophages, lymphocytes, fibroblasts and giant cells. Hyperplasia and severe necrosis of the ependymal cell lining of the lateral ventricle were observed. Moreover, extensive subependymal inflammatory cell infiltration was seen, accompanied by neovascularization and fibroblastic proliferation in the neuropil. Similar lesions that included neuronophagia, demyelination, satellitosis, perivascular lymphocytic cuffing, liquefactive necrosis and gliosis were previously observed [5, 15]. The changes in the ependymal cell lining are secondary to the occurrence of cysts inside the ventricle. Cerebral echinococcosis has been reported in the cerebra of 43 Armenian sheep, inducing symptoms similar to those of cerebral coenurosis [11]. The hydatid cyst exhibited rich vascularity in the wall with a thick and shiny outer layer (cuticula) and an inner germinative membrane, and smaller vesicles and scolices attached to the walls. Microscopically, the cyst fluid contained free scolices and typical parts of the multilayer membrane [11]. The *Coenurus* cysts were larger, separated easily from the surrounding tissues and were superficially located. The surrounding tissues of the cysts had a smooth surface and were dark pink in color. The cysts had no vascularity and possessed 20–75 scolices attached to the wall [11]. The characteristics of the cysts in the present study are extremely similar to those of *Coenurus cerebralis,* except for the intraventricular location. In the current investigation, ventricular coenurosis was associated with the presence of *Oestrus ovis* larvae infection in the frontal sinuses. An association between *Oestrus ovis* larvae and surgically treated cases of sheep coenurosis has been reported [7]. In the present work, the association of the *Coenurus* cyst with *Oestrus ovis* could possibly be attributed to the high incidence of the latter among sheep and goats in Egypt [12].

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