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Research Paper

Clinicopathological study on *Coenurus cerebralis* in small ruminants of Kashmir-A case series study

S. Majid, T. Mufeeda, S.A. Shah, Insha A, A.Q. Mir, I.M. Allaie *****, Z.A. Wani, S.R. Tramboo, M.S. Mir, A.B. Beigh and S.A. Kamil

Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, Srinagar Jammu and Kashmir (India)
*e-mail: *idreesmehraj@skuastkashmir.ac.in*

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ABSTRACT

***Coenurus cerebralis* is the larval stage of *Taenia multiceps* which affects the central nervous system giving rise to the neurological signs in sheep and goats. This study was envisaged to investigate the clinical aspects of the disease and also pathomorphological changes in the brain in naturally infected sheep and goat reared at Mountain Research Center for Sheep and Goat, SKUAST of Kashmir. A total of six (6) weaner sheep and goats, about 6-9 months of age, which died of this disease were taken into the study. The clinical examination of the affected animals revealed nervous symptoms as incoordination, disorientation, head pressing, seizures, staggering gait and circling motion, while the post mortem examination of the animals revealed presence of coenurosis cyst in the brain most commonly in the cerebral hemispheres. The gross examination of the cyst revealed multiple scolices attached to the wall, inside which hook like structures were seen. Morphometric analysis of the hooks confirmed them to be that of *Coenurus* cyst. On histologic examination, all the cysts were lined by stratified squamous epithelium with intraluminal keratinaceous debris. The microscopic examination of the affected brain tissue revealed demyelination, degeneration, mononuclear cellular infiltration, neuronal necrosis and cuffing. The study provides an insight about the common clinical features and the gross and microscopic pathological lesions of the disease which are important for early identification of the causative agent and confirmatory diagnosis of this disease.**

Key words: Clinical signs, *Coenurus cerebralis*, Cyst, Goat, Brain, Pathomorphology, Sheep,

Coenurus cerebralis is the metacestodal stage of *Taenia multiceps* and is responsible for causing coenurosis in sheep and goats. This parasitic infection, widely recognized as Gid, has the potential to appear in different organs such as the lung, spleen, liver, and heart apart from central nervous system, leading to significant economic hardships for impoverished farmers due to increased morbidity, mortality, and the expenses associated with treatment and control (Tas *et al*., 2023). *Coenurus cerebralis* affects the central nervous system of sheep, which acts as intermediate host for *Taenia multiceps*, and gives rise to the neurological signs resulting in death of the animal (Christodoulopoulos, 2007). The manifestations of this disease occur in two forms i.e. acute and chronic form. The acute form occurs during the migratory phase of the larvae nearly about ten days after the ingestion of tapeworm eggs with contaminated feed. Small ruminants of 5 to 6 weeks of age show acute form, which is associated with an inflammatory and allergic reaction. In chronic form, the affected small ruminants show the neurological signs such as depression, incoordination, circling behaviour, visual defects, teeth grinding and poor appetite (Mohammadi *et al*., 2021; Varcasia *et al*., 2022). This case series describes clinical and pathomorphological characteristics of coenurosis in small ruminants.

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MATERIALS AND METHODS

Six weaner small ruminants comprising of two sheep, one Corriedale female and one crossbred female, and four goats, including one Bakarwal female, two Boer males, and one Pashmina male, aged between 6 to 9 months, at Mountain Research Centre for Sheep and Goat, SKUAST-K, developed neurological signs and finally expired. The six animals were then referred to the Division of Veterinary Pathology, F.V.Sc. & A.H., SKUAST-K, for post-mortem examination. During post-mortem examination parasitic cysts were found in the cerebral and cerebellar area and the gross pathological lesions were recorded. The size of the cysts was measured and brain samples were collected for histopathological examination.

For histopathological studies, tissue samples were collected in 10% buffered formalin for fixation in order to prevent autolytic changes. The samples were processed as per Lillie (1965) with little modifications. The tissue was kept in capsules with proper labelling and then washing was done in order to drain out formalin. The dehydration was achieved by treating tissues with different grades of alcohol. After that the tissue sample was kept in benzene for the firmness of the tissue in order to facilitate section cutting. The casting of blocks was done with the help of L-molds and then section cutting was achieved by rotatory microtome. Afterwards deparaffinization was done with the help of xylene and then the tissue was stained with haematoxylin and eosin to observe pathomorphological changes in the affected tissues.

For parasitological examination the fluid filled cysts were sent to Division of Parasitology, F.V.Sc. & A.H., SKUAST-K for identification. The gross and the morphological appearance of the cysts were evaluated for identification. On gross examination, multiple scolices were found attached to the thin wall. A portion of each cyst containing multiple scolices was cut and placed between the two slides which were then tied with a piece of thread and placed in 10% formalin for 24 hours for fixation. The pressed scolices were then dislodged from the slides for staining with borax carmine stain as per the method described by Shahardar *et al.* (2020). The stained slides were then examined under microscope for micrometry of hook like structures present in the scolex. Based on the multiple scolices attached to the wall of the cyst and micrometry of hooks, the cysts were thus identified as *Coenurus cerebralis*.

RESULTS AND DISCUSSION

During the one-year study period, mostly the young animals of around 6-9 months of age had this disease condition which is similar to the findings of other workers who also reported infection in animals of 6-18 months of age (Athar *et al*., 2018; Islam *et al*., 2016). The affected animals initially exhibited mild signs like inappetance, lethargy, separation from flock and occasional head pressing.

At later stages, the animal showed emaciation, depression, and marked nervous signs including head tilt, dilation of pupil, nystagmus, ataxia, circling movements, convulsions and finally lateral recumbency followed by death. These observations are similar to findings of Yoshino and Momotani (1988); Athar *et al*. (2018); Scott (2012) and Gholami *et al.* (2022). No significant differences were found between the species, gender and breeds of animals. Parasitic cysts present in the cerebrum and cerebellum were having varying size, fluctuant consistency with multiple white coloured scolices attached to their walls (Fig A, B, C).

The overlying cerebral tissue was thin, atrophied, congested and tore off easily. These findings were in accordance with Nourani and Kheirabadi (2009). In some cases, the cranium showed a large cyst over the posterior portion of the left cerebral hemisphere resulting in the compression over the ventral portion of the cerebral hemisphere leading to a marked perforation in the sphenoid bone as reported earlier (Achenef *et al*., 1999; Guclu *et al*., 2006). In two cases, the cyst almost covered the entire caudal hemisphere resulting in the atrophy of the brain tissue.

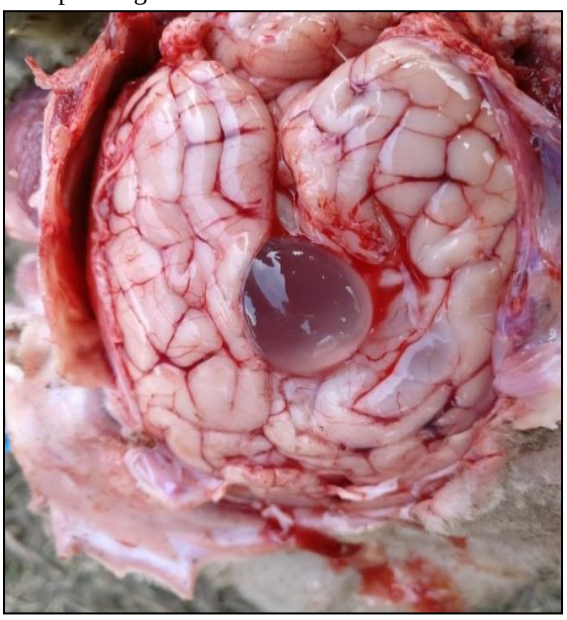


Fig. A: Large-sized bladder-like fully developed *Coenurus cerebralis* cyst in brain

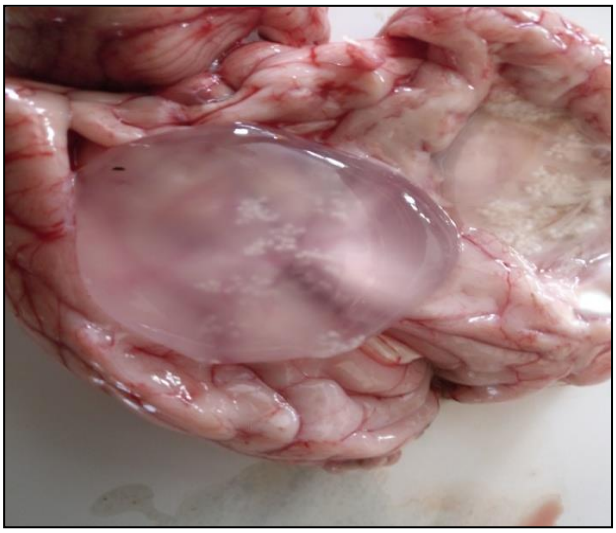


Fig. B: ***Coenurus cerebralis*** **cyst containing translucent fluid**



Fig. C: ***Coenurus cerebralis*** **cyst (Gross)**

The cyst was possessing thin wall with numerous scolices attached to it, the wall being without brood capsules that differentiated it from hydatid cyst as reported by Gholami *et al.* (2022). Each scolex possessed four suckers with two rows of large and small hooks in each sucker (Fig D, E). The micrometry of the hooks of the stained scolices confirmed it to be *Coenurus cerebralis*. Dar *et al*. (2016) identified *Coenurus cerebralis* from the palpebral conjunctiva of sheep based on micrometry of hooks in the scolices. Bashir *et al*. (2020) recorded *Coenurus cerebralis* from the skull of Kashmir Merino sheep in Kashmir valley. The workers also observed similar clinical features as reported in this study.

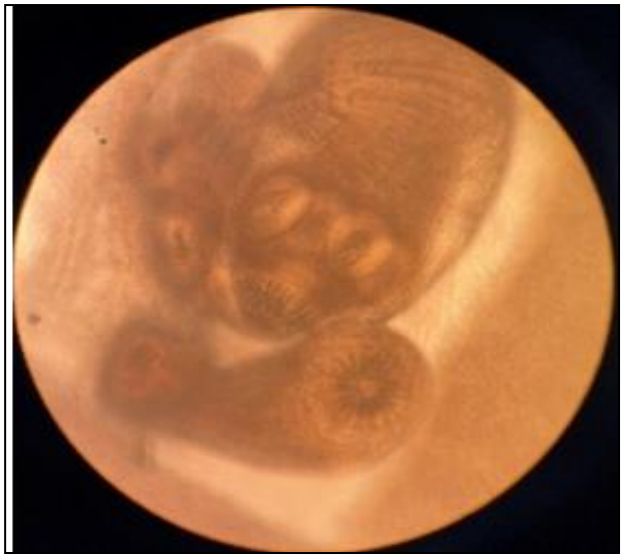


Fig. D: ***Coenurus*** **cyst multiple scolices with hooks (10X)**

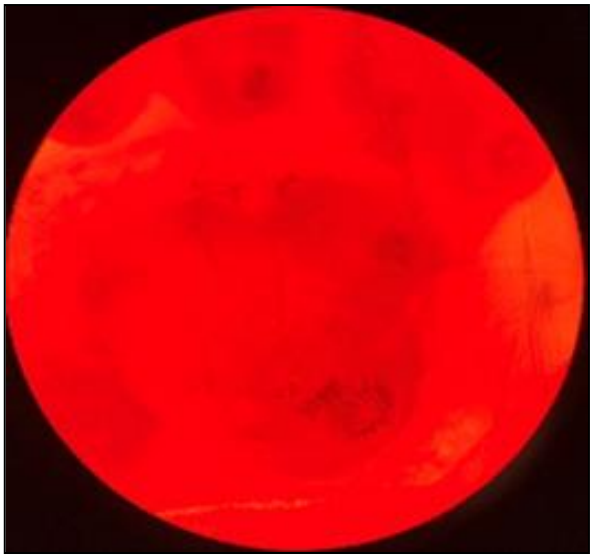


Fig. E: ***Coenurus*** **cyst scolex with single row of hooks (10X)**

The microscopic examination of cysts revealed cellular exudates with calcified areas in the cerebral parenchyma of sheep. The histopathological sections of cerebellar tissues of sheep and goat revealed neuronal degeneration, hyperaemia and mononuclear cell infiltration (Fig. F). Severe cases also reported perivascular cuffing on the micro sections of brain (Fig. G). The other histopathological lesions included microgliosis, astrocytosis, demyelination, necrosis, meningitis and hyperaemia of the meningeal blood vessels (Fig. H & I). The affected brains showed reddish-yellow lines of necrotic-suppurative inflammation due to onchosphere migration. A pyogenic membrane enclosing the cystic wall was also observed in few postmortem cases. The meninges of the affected animals revealed hyperplasia in association with liquifactive necrosis. The microscopic changes observed in the present study were in line with the findings of Kheirandish *et al.* (2012); Ioannidou *et al.* (2015);

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Gholami *et al.* (2022) and Tas *et al*. (2023) and no significant changes were found associated with a particular species, gender or breed.

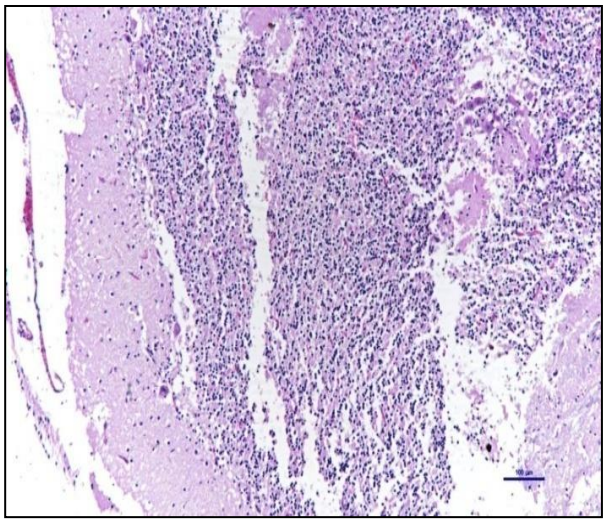


Fig. F: **Photomicrograph of a section of brain revealing neuronal degeneration along with severe mononuclear cell infilitration (H&E, 10 X)**

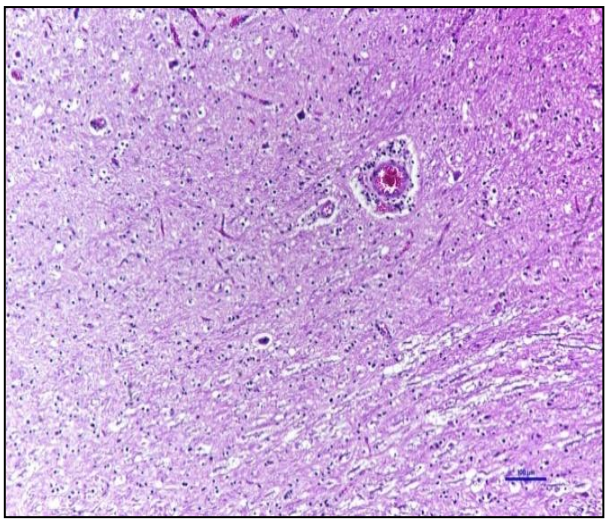


Fig. G: **Photomicrograph of a section of brain revealing perivascular cuffing and fibrous tissue proliferation (H&E, 10 X)**



Fig. H: **Photomicrograph of a section of brain revealing severe vascular congestion along with neuronal degeneration (H&E, 10 X)**

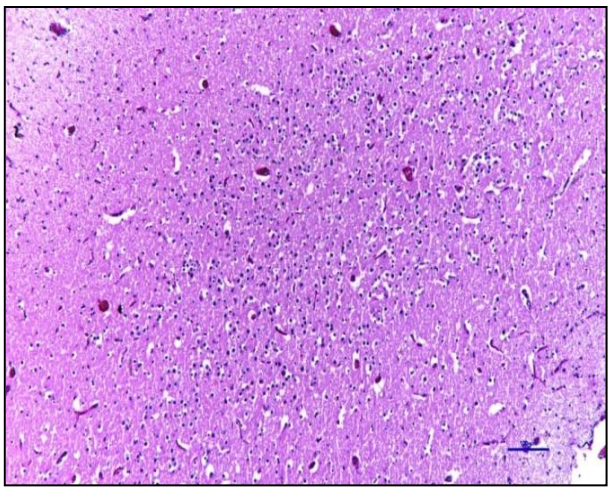


Fig. I: **Photomicrograph of a section of brain revealing severe gliosis and neuronal necrosis (H&E, 10 X)**

CONCLUSION

Coenurosis is widespread among small ruminants of Kashmir valley. The disease is more common among weaner animals of both sheep and goat irrespective of the sex of animal. The study also provides an insight about the common clinical features and the gross and microscopic pathological lesions of the disease which are important for early identification of the causative agent and confirmatory diagnosis of this disease.

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