Coenurus cerebralis, a bladder worm stage of *Taenia multiceps*, is a commonly occurring parasitic disease that affects ruminants, horses, pigs and human beings [13]. Coenurus cysts are frequently found in nervous system including brain and spinal cord. Nervous lesions, due to presence of cysts, lead to neurological symptoms which results in ataxia, hypermetria, blindness, head deviation, headache, stumbling and paralysis [13]. However, the animals in most cases remain apparently healthy without clinical symptoms and condition was diagnosed only after the death of the animal [13]. Coenurosis is common in sheep and goats worldwide [12] but coenurus cysts have been rarely reported from cattle [2, 6, 8, 9, 15, 16]. Nevertheless, 3 cases of naturally infected cattle from the same province (Erzurum) in Turkey were reported in the present study and relative clinical, morphological and histopathological features were described.

**Material and Methods**

**ANIMALS**

The study material of this study consisted in 3 calves slaughtered in the same slaughterhouse in Erzurum which were infected with *Coenurus cerebralis*. The first calf, 6 months old, was a Simmental male, whereas the 2 others, 9 and 11 months old, respectively, were Brown Swiss males. They were bred under extensive breeding (there is the use of common pasture) and they were stemming from 3 different herds.

Regular visits were made to the abattoir located in Erzurum. During each visit, after the slaughtering process skulls of each cattle were dissected by butchers working in the abattoir. Brain of each cattle was systematically inspected by visual inspection, palpation and incisions against *Coenurus* cysts.

**PARASITOLOGICAL EXAMINATIONS**

The gross and the morphological appearance of the cysts were evaluated and identified morphologically, according to a combination of criteria (cysts were large, white, had translucent structures and numerous protoscoleces attached to the wall; scolex had a double ring of rostellar hooks) [3, 17]. Viability of each metacestode was assessed by microscopic examination of the cestod after incubation at 37°C for 5 minutes to induce evagination and motility of the protoscoleces.

**HISTOPATHOLOGICAL EXAMINATIONS**

Tissue samples were taken from the brain and fixed in 10% neutral buffered formalin, processed and embedded in paraf-
Sections of 5 μm were cut, stained with haematoxylin-eosin, Period acid-Schiff (PAS) and examined microscopically [10].

Case reports

Clinical Signs

Anamnesis about the clinical signs of these animals was obtained from the animal owners. The first calf (6 months old) was slightly depressed, committed uncontrolled movements and occasional circling, exhibited inability to swallow. The second (9 months old) presented the same clinical signs. The third one, approximately eleven months old, had developed ataxia over the past two weeks, was depressed and mild opisthotonos, uncontrolled movements, occasional circling, impaired vision were also observed. The appetite and the rectal temperature were remained normal in the 3 cases.

Macroscopic Lesions

Cysts containing clear fluid with numerous scolexes were detected in the brains of three calves. One cyst located in the vermis cerebelli of cerebellum (figure 1) was seen in the first calf. In the second animal, a first cyst (size: 7 x 5.5 cm²) was located in the right cerebral hemisphere, between frontal and temporal sections and a thin layer of brain tissue and a second cyst (size: 6.5 x 5 cm²) occupied the occipital section of left cerebral hemisphere. Two cysts were also found in the third calf: the first cyst (size: 11.5 x 10.4 cm²) was located in the right cerebral hemisphere (figure 2), between occipital and temporal sections and a thin layer of brain tissue, whereas the second cyst occupied the gyrus marginalis of left cerebral hemisphere.

The cyst was large, white and translucent, and had numerous protoscoleces attached to the wall. Microscopic examination of protoscoleces showed that each scolex had a double ring of 32 rostellar hooks (figure 3). The large hooks were 150 to 160 μm long and the small ones were 100 to 110 μm long.

Histopathological Findings

Using histopathological examinations, a non purulent meningoencephalitis was present in the cerebellum of the first animal and in the cerebrum in the 2 other calves. A non purulent granulomatous inflammation surrounded by a fibrous capsule was evidenced. Necrotic debris accumulated in center and few calcification areas were also seen. In periphery, cellular infiltrate associated many foreign body giant cells, eosinophils, histiocytes, epithelioid histiocytes and lymphocytes cell (figure 4A). In all cases, severe hyperaemia and perivascular cuffing were observed in the vessels (figure 4B) coupled to infiltrates with mononuclear cells and thickening of meninges. Neurons progressively degenerated to necrosis and demyelinated areas associated with diffuse microgliosis and astrocytosis were found. Moreover, in the brain of second cattle, calcification deposits in focal areas (figure 4C), accompanied these findings. In the cerebrum and cerebellum, laminar layer belonged to parasite was stained positively with Period Acid-Schiff (PAS) (figure 4D).

Discussion

The size and location of the Coenurus cysts appears to be important in the pathogenesis. The predilection site of Coenurus cysts in most cases is the central nervous system and spinal cord. Researchers reported cyst location in calves from...
anterior part of the cranial cavity [9], in the tempo-parietal lobe, occipital lobe, cerebrospinal lobe and spinal cord [8], frontal lobe [8, 16] right cerebral hemisphere and left cerebral hemisphere [5]. As it was seen Coenurus cysts were generally located in the cerebrum. Besides, ISLAM and RAHMAN [8], ACHENEF et al. [1] and GIADINIS et al. [6] recorded Coenurus cysts in the cerebellum. In this study, in one case Coenurus cysts were found in cerebellum (in the vermis cerebelli) and in two cases in the cerebrum (the occipital section of left cerebral hemisphere, the gyrus marginalis of left cerebral hemisphere, the right cerebral hemisphere between frontal and temporal sections, the right cerebral hemisphere between occipital and temporal sections). DINEV et al. [4] reported that size of the cysts varied from 2-3 to 5-6 cm in diameter in calves. In this study, the diameter of the cysts varied from 5-6.5 to 10.4-11.5 cm. Also, microscopic examination of protoscoleces showed that each scolex had a double ring of 32 rostellar hooks ranging from 100-110 μm to 150-160 μm. These findings were in agreement with those of GIADINIS et al. [5, 6] but were higher than observations reported by YOSHINO and MOMOTANI [16].

Coenurosis is a nervous disease and clinical syndrome is based on location and size of the Coenurus cyst in the brain. In cattle, the clinical sings of coenurosis are associated with more specifically ataxia, uncontrolled movements, occasional circling [4-6], incoordination [5, 9], impaired vision [9], paralysis of limbs, exhaustion and death [4]. In this study, ac-

FIGURE 3: Coenurus cyst protoscolex showing a rostellum with ‘double-crown’ hooks. Wet preparation, X 40.

FIGURE 4: A. Granulomatous inflammation and foreign body giant cells (arrow) (Haematoxylin-Eosin, X 10); B. Perivascular cuffing around in the vessels (Haematoxylin-Eosin, X 10); C. Calcification deposits in focal areas (arrow) (Haematoxylin-Eosin, X 40); D. Laminar layer (arrows) belonged to parasite (Period Acid-Schiff (PAS) X 10).
According to the anamnesis obtained from the farmers, specific clinical symptoms (slightly depression, uncontrolled movements, occasional circling, inability to swallow, ataxia, mild opisthotonos and impaired vision) of coenurosis were seen in the 3 calves.

Common features of the histopathological lesions in coenurosis were inflammations, congestion, neuronophagia, focal haemorrhage, demyelination, satellitosis, perivascular cuffing, necrosis and gliosis leading to formation of microglial nodules [5, 7, 11, 14]. In our study, histopathological features of coenurosis were nearly similar to the reported above; except that intense calcification deposits were observed in the brain of the second calf and that degenerative changes in neurons were noted in the 3 cases.

As a conclusion, on the basis of the data of this study, it can be said that clinical, morphological and histopathological properties of sheep and cattle coenurosis are similar. It should not be forgotten that coenurosis can be seen in cattle. From a clinical point of view, veterinarians should consider coenurosis in the differential diagnosis of central nervous system diseases in cattle.

References