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Occurrence of non-cerebral coenurosis in sheep

G. Christodoulopoulos[1,2]*, A. Kassab[2] and G. Theodoropoulos[3]

[1]Clinical Veterinary Medicine Department, School of Veterinary Medicine, University of Thessaly, PO Box 199, Karditsa GR-43100, Greece: [2]Aridland Agriculture Department, Faculty of Food and Agriculture, United Arab Emirates University, PO Box 15551, Al-Ain, Abu Dhabi, United Arab Emirates: [3]Department of Anatomy and Physiology of Farm Animals, Faculty of Animal Science and Aquaculture, Agricultural University of Athens, 75 Iera Odos St, Votanikos, Athens 11855, Greece

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Abstract

This study reports seven rare cases of non-cerebral coenurosis in sheep. The sheep were slaughtered in abattoirs of Abu Dhabi (United Arab Emirates) but originated from India, Iran, Oman and Sudan. The prevalence of infection with non-cerebral coenurosis was 0.008%. The locations of the cysts were the triceps brachii muscle, the diaphragm, the infraspinatus muscle of the shoulder, the muscles of the thigh and the abdomen, and the ommentum. The *Coenurus* cysts were surrounded by a fibrous, semi-opaque membrane, cloudy white in colour. Altogether, 12 cysts were recovered and all contained a single bladderworm. Cysts had a volume of $7.3 \pm 1.30\,cm^3$ (ml), with 7.3 ± 4.0 clusters of scolices, and an average number of scolices 75.3 ± 24.4. These features in sheep were similar to those reported for non-cerebral *Coenurus* cysts in goats. No cysts were found in the brain or spinal cord of any of the infected sheep. No clinical evidence of non-cerebral coenurosis had been recorded during the antemortem veterinary inspection of the infected sheep.

Introduction

Coenurosis (gid or sturdy) is caused by *Coenurus cerebralis*, the bladderworm stage of *Taenia multiceps*, which develops predominantly in the brain or spinal cord of many mammalian species, including humans, and especially sheep (Ing *et al.*, 1998; Sharma & Chauhan, 2006; Christodoulopoulos, 2007; Christodoulopoulos *et al.*, 2008). However, there have also been reports of *Coenurus* cysts in subcutaneous or intramuscular tissues and the abdominal cavity in ungulates but especially goats. In goats, these non-cerebral *Coenurus* cysts have been called *Coenurus gaigeri*, and in sheep they have been called *Coenurus skrjabini* (Verster, 1969; Sharma & Chauhan, 2006; Schuster *et al.*, 2010). Meanwhile, the metacestodes of *Taenia serialis* cause cysts in subcutaneous and muscle tissues of hares and rabbits, known as *Coenurus serialis* (Verster, 1969). The objective of the present study was to report the occurrence of non-cerebral coenurosis in sheep and to describe its macroscopic features.

*E-mail: gc@vet.uth.gr

Materials and methods

Collection and examination of sheep carcasses

An abattoir survey of non-cerebral coenurosis in sheep was performed in three abattoirs in the city of Al Ain of the United Arab Emirates (UAE) between October 2010 and May 2011. During this period, after the customary examination by the meat inspectors, any sheep carcass suspected of displaying non-cerebral

Table 1. Macroscopic characteristics of *Coenurus* cysts found in sheep ($N = 7$).

	Volume of cyst (cm^3)	Number of scolices per cyst	Number of clusters per cyst	Number of scolices per cluster
Mean ± SE	7.33 ± 1.30 ($n = 12$)	75.33 ± 24.43 ($n = 12$)	7.25 ± 4.03 ($n = 12$)	8.83 ± 2.12 ($n = 87$)
Range	1–16	5–357	1–14	1–28

coenurosis was brought to the attention of the authors for further investigation.

Any carcass identified for investigation was inspected by visual examination as well as by palpation. The suspected cyst was revealed by dissecting the surrounding tissue. If a *Coenurus* cyst was suspected, it was removed, placed in a plastic bag that was labelled and transferred in a portable fridge at 4–8°C to the laboratory within 1 h.

The following data were recorded: the age and the country of origin, the position of the *Coenurus* cysts in the body, the number of the cysts, as well as the presence of any other kind of cestode cysts found. The brain and the spinal cord were examined for the presence of any *Coenurus* cysts.

Examination of cysts

A cyst was initially identified as a *Coenurus* cyst based on the inclusion of a bladder that was filled with watery fluid and having a thin and transparent wall with numerous scolices attached to its inner surface. Upon laying the bladderworm on a flat surface, the number of scoleces and their arrangement in clusters were counted.

To confirm the identification, a piece of the larval membrane containing a cluster of scoleces was submerged in warm tap water (37–39°C) for 30–60 min to provoke evagination of the scolices. Subsequently, the cluster was placed on a slide, a cover slip was pressed tightly on it and finally the scoleces of the cluster were examined under a light microscope. The identification of the *Coenurus* larvae was based on the recognition of the rostellar hooks along with the four surrounding suckers in the evaginated scolices.

Results and discussion

Only 7 sheep of 90,415 (0.008%) slaughtered were found to have non-cerebral *Coenurus* cysts. Three sheep originated in India, 2 from Iran, 1 from Oman and 1 from Sudan. All 12 cysts contained a single bladderworm with multiple scolices (table 1). The cysts were located in the triceps brachii muscle (fig. 1), the diaphragm, the infraspinatus muscle, the muscles of thigh and the abdomen, and in one case a *Coenurus* cyst was found attached to the omentum. One cyst of volume 1 cm^3 was found in the subcutaneous tissue of the thigh. In the cases of infestation in the muscles of thigh and the abdomen, the cysts affected more than one muscle (table 2). No clinical evidence for non-cerebral coenurosis

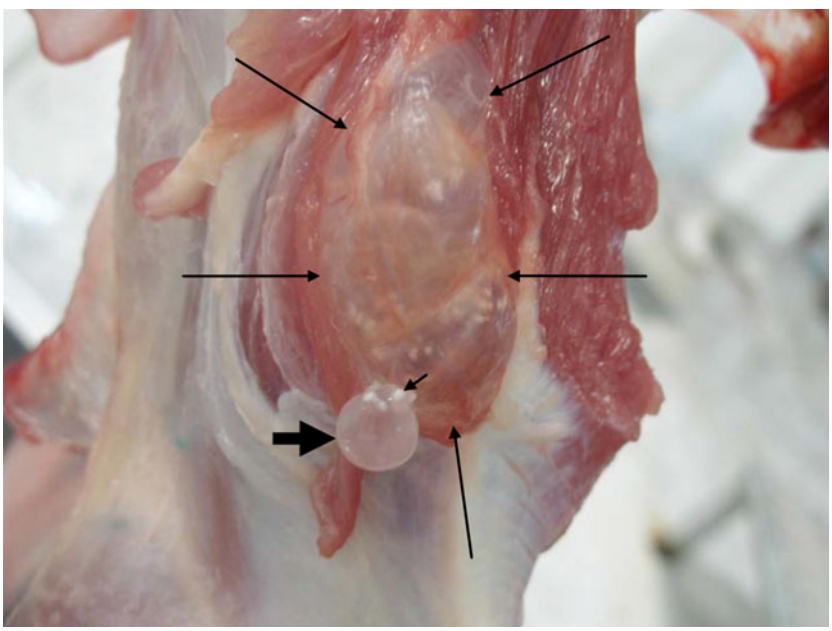

Fig. 1. *Coenurus* cyst attached to the triceps brachii muscle. The outer membrane of the bladderworm was ruptured during skinning so the bladderworm protrudes and a cluster of scoleces is revealed. The margins of the *Coenurus* cyst (size: 7 × 3.86 cm) are indicated by the long, thin arrows, the bladderworm (diameter: 1.38 cm) is indicated by the thick, short arrow, and the cluster of scoleces is indicated by the thin, short arrow (a colour version of this figure can be found online at http://www.journals.cambridge.org/jhl).

Table 2. The occurrence, the age of sheep and the location of *Coenurus* cysts.

Origin of sheep	Age of sheep (months)	Position of *Coenurus* cysts (number of *Coenurus* cysts)
Iran	4	Infraspinatus muscle (1), diaphragm (1)
Iran	>24	Thigh (1)
India	4	Thigh (2)
India	6	Infraspinatus muscle (1)
India	24	Triceps brachii muscle (1), ommentum (1)
Oman	>24	Abdomen (1), ommentum (1)
Sudan	12	Thigh (2)

had been recorded during the antemortem veterinary inspection.

A prevalence of 2.6% has been reported for non-cerebral coenurosis in goats in Iran (Oryan *et al.*, 2010). To the authors' knowledge, no epidemiological data are available for the situation in sheep. The most recent reports of non-cerebral coenurosis in sheep trace back to the 1930s (Schuster *et al.*, 2010). Verster (1969) reported that the disorder occurred only in an isolated area of Kazakhstan; however, the present data suggest that the disorder occurs in Asia, the Middle East and Africa. Interestingly, in the literature there are reports of the occurrence of non-cerebral coenurosis in goats in Asia, the Middle East and Africa (in India, Iran and Oman) (Sharma *et al.*, 1995; Sharma & Chauhan, 2006; Oryan *et al.*, 2010; Schuster *et al.*, 2010).

The *Coenurus* cysts found in the present study were of small size and contained few scoleces in comparison to the cyst size and number of scoleces reported for cerebral coenuri. It is accepted that cerebral coenuri in sheep can reach 95 cm^3 in size and can contain up to 700 scolices (Boev *et al.*, 1964; Schuster *et al.*, 2010). The number of scolices and the size of cysts reported here for sheep non-cerebral coenurosis are similar to the findings for non-cerebral coenurosis of goats reported by Schuster *et al.* (2010), who found cyst sizes to vary between 1 and 40 cm^3 and the number of scolices per cyst to be between 46 and 474.

In conclusion, non-cerebral coenurosis in sheep is a rare disorder. The taxonomic status of the non-cerebral *Coenurus* cysts remains to be determined by molecular techniques.

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