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Coenurosis in sheep: basic and therapeutic aspects

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Abstract. Observations were performed on 17 sheeps of different age and breed, diagnosed with cerebral coenurosis. Surgical procedure consisted in a large craniotomy, general anaesthesia was realised by neuroleptanalgesia using acepromazine and ketamine. Surgical procedure included: skin incision, establishing the craniotomy site (4/4 cm on 4/5 cm); bone plate excision, duramater incision, exploration of the nervous tissue, extraction of the parasitic vesicle, and finnaly the bone reconstruction by osteosyntesis. From 17 cases, 14 healed completly, 2 were culled and one died.

Keywords: Coenurosis; Cyst; Sheep; Treatment; Surgical procedure.

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Introduction

The ovine coenurosis is a fatal disease produced by the presence and development in the brain of *Coenurus cerebralis* cysts, the larval stage of *Taenia multiceps* (Oryan et al., 2014). In 80-90% of cases, the cyst is located in one cerebral hemisphere, whilst in 5-10% of cases, it is localised in the cerebellum; rarely it involves two sites in the brain of the affected animal (Scott, 2012). It affects young sheeps and goats, the age of which ranges up to 2 years old (Oge et al., 2012). The adult form parasitizes the small intestine in dogs, wolfs and foxes. The parasitic cysts is made up of a thin membrane and it contains a quantity of 30-100 ml liquid which is clear, colourless. It develops very slightly in the brain, and at its final stage it can reach the dimension of a hen's egg. The liquid that accumulates exerts pressure on the nervous substance leading eventually to its atrophy. Contamination of pastures with dog faeces that contain oncospheres and the subsequent ingestion of these oncospheres by sheep can result in larval invasion of the central nervous system and fatal clinical disease, known as coenurosis or gid. Heads and offal are frequently offered to dogs during home slaughtering and this likely maintains high, year round, environmental contamination by *T. multiceps* eggs expelled with the faeces of infected dogs (Scala, 2007). The disease is more commonly reported in growing sheep aged 6–18 months where it presents as a slowly progressive focal lesion of the brain, typically involving one cerebral hemisphere (Scott, 2012). In coenurosis, from about 1–3 weeks after infection, young *C. cerebralis* larvae migrate in

the brain, and it is possible that either these bladder worms carried the *S. dysgalactiae* to the brain, or the injuries caused by larval migration in some way facilitated bacterial passage across the blood–brain barrier (Christodoulopoulos, 2007). The time taken for the larvae to hatch, migrate and grow large enough to present nervous dysfunction varies from 2 to 6 months. Ataxia, incoordination, paresis, head pressing, circling, blindness and coma may be observed in affected sheep. An acute meningoencephalitis may develop if a large number of immature stages migrate in the brain and young lambs/kids aged 6-8 weeks are most likely to show signs of acute disease (Giadinis et al., 2012). Treatment is based on surgical removal of the *Coenurus* cyst after general anaesthesia of the animal; the approach has a very good success rate, especially after accurate localisation of the lesion. Cerebral and non-cerebral coenurosis are zoonotic diseases and there are more than 100 reports of human infection with this metacestode (Oryan et al., 2014).

Materials and methods

Our observations were carried out on 17 sheeps diagnosed with cerebral coenurosis of a different age and breed, in a mediocre or poor condition due to feeding difficulties. Diet was not the case as the nervous manifestations caused feeding difficulties.

General anaesthesia by neuroleptanalgesia was carried out: acepromazine (Calmivet) in a dose of 0.5 mg/kg of body i.v., and ketamine (Ketamidor) 5 mg/kg of body i.m., 3-4 minutes before the beginning of operation. The i.v. perfusion has been administrated, glucose sol. 5% during the surgery. The sheep were secured in the sternum- abdominal decubitus, with the under-mandibular region fixed on a pillow. Aseptical preparation of the surgical site, and was isolated with drapes. Local anaesthesia was made by infiltration with xiline solution 1% in the shape of a square of a rectangle on the incision spot of skin.

The surgical protocol consisted of:

- Skin incision and the sub-adjacent tissues by scalpel to the periosteum, on the median line of the calvarium bone, with a length of 6-8 cm, the skin on the both sides (figure 1).
- Marking by scalpel the limits of the bone flap that will be remove by osteotomy, of a square shape (4/4 cm sided), or rectangular (5/4 cm).
- Osteotomy of the bone flap by an oscillating bone saw, very carefully, to prevent the penetration of the saw blade in the nervous substance. When the bone flap present a little mobility, it shall be detached by means of periosteal elevator (figure 2).

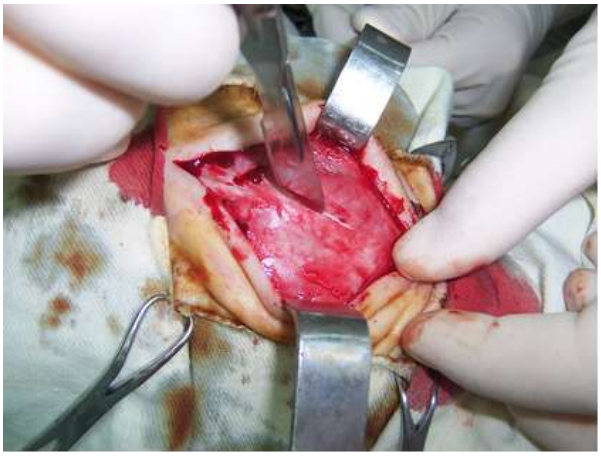

Figure 1. Surgical approach of the calvarium bone

Figure 2. Osteotomy of the bone to open the cavity

- Examination of cerebral hemispheres before the incision of dura mater membrane, by inspection and palpation with the finger tip to feel the consistency.
- Identification of cyst, is much easier when the cyst is located immediately under dura mater, or at a depth of 2-3 mm (figure 3).

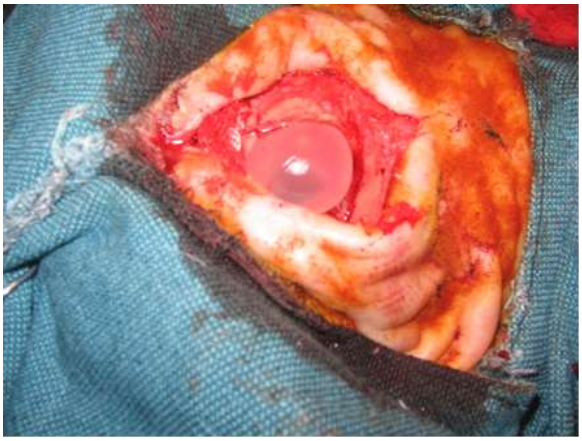

Figure 3. Cyst protrusion on the surgical site

- Removal of cyst shall be performed in different ways as related to the place and depth where it s situated. The incision of dura mater has been performed. In the case of 2 animals, the parasitic cyst was localized at the surface of brain and by the simple inclination of the head, the bladder has been removed. In the case of 9 sheep, the cyst was at 2 mm depth, so it could have been palpated with the finger. In this case the nervous tissue of approximately 2 cm has been unwound, after which 5 ml of liquid were extracted from the cyst. With haemostatic forceps, the membrane of the cyst was grasped and it was extracted out carefully to prevent breaking. The cyst in the case of 4 sheep, was situated profoundly and to identify it we have used the classical method, by probing with a needle, in several sites through the brain substance, carefully, to avoid the large vessels, until some liquid expressed on the needle. A certain amount of liquid was extracted, and around the needle it was performed o incision of 1 centimetre length with the scalpel. Needle was kept in the same position and the incision carried out, and a part of the cystic membrane was fixed. The needle was retracted and the cyst extracted with the forceps. When the parasitic cyst has a great quantity of liquid, in this position, more liquid should be extracted to facilitate the cyst removal. The parasitic cyst was grasped with a second forceps and by successive twisting motions the cyst was removed (figure 4).

Figure 4. *Coenurus* cyst extraction

- Dependent to cyst size, a larger or smaller cavity remains in the brain. When the cyst membrane was broken during the extraction procedure, a part of liquid will remains in the cavity. This fluid need to be extracted with a blunt catheter attached to a syringe. When haemorrhages occur, we shall try the haemostasis with surgical sponges with adrenaline solution 1%.
- Closing the surgical wound: after the removal of the cyst, at the bone flap as well as at the calvarium bone 4 orifices were made with a drill on the 4 sides. The orifices on the calvarium bone are facilitated because after the cyst removal, the tension of brain on the median part is decreased considerably. The calvarium bone reconstruction was performed by osteorraphy, after fixed the bone flap on the

initial anatomical position. The metallic wire shall be first introduced in the orifices in the calvarium bone, from inside out or the other way round, then the ends of wire will be introduced in the holes of on the bone flap. The periosteum was closed with an interrupted resorbable suture, and the skin was sutured with nonresorbable.

A thick dressing of hydrophilic cotton is applied, which shall be changed at the end of 2 days, then at the end of 4-5 days. Pain management with Flunixin meglumin (Flunixin 0.5 mg/kg b.wt.) and antibiotico-therapy (Enrofloxacin 2.5 mg/kg b.wt.) was performed, during the first 5-6 days, to prevent any possible complication.

Results and discussions

Of the 17 animals operated on, 14 recovered, 2 were culled and 1 died, during the surgery by ex-vacuum collapse. To establish the diagnosis of cerebral coenurosis we evaluated the general condition of the animal, its anamnesis and clinical findings. The clinical evolution of disease, the nervous manifestations allowed positive diagnosis of coenurosis. The most part of the cases under observation and treated by surgical approache, presented general clinical signs, head deviation, difficulties of feeding, difficulties in catching up with the flock or the separation from it, the giddy gait induced in the infected animal, its staggering (on the left or right side) more or less obvious. The bone softening, indicates the more superficial position of the cyst, it also helps us at the incision of the neuro-cranium. The animals that have been operated in by us presented clinical forms of the disease. The pressure of the parasitic cyst on the cerebral substance caused behaviour modifications, dromomania, amaurosis, staggering, the direction of circling and head deviation (most of all). We did not have any case of losing the balance.

The perform a large craniotomy, is more time consuming than trepanation with trephine, but it provides a larger space of examination the cerebral hemispheres and a better chance for exploring and identifying the cyst bladder. It provides us with the advantage that we might be able to appreciate also, by palpation, the consistency of the nervous tissue, the presence of the cyst, without performing many probing by needle. The extraction of parasitic vesicle is facilitated by the broader surface, exposed by osteotomy. A remarkable advantage is the fact itself that the operating wound is induced by the application of the lambo osseous in its previous position and it's fixing by means of metallic threads as compared to the classical method where the neuro-cranium is closed only by the suture of periostem and skin.

We would like to mention that the greatest part of the animals operated were animals of a great value, among which a ram for reproduction, in a farm of 2000 sheeps. Many farmers choose to slaughter those sheep fit for marketing or economic reasons and euthanasia those in poor condition. Cerebral coenurosis is a disease of small ruminants most often bred with extensive methods (Evangelisti et al., 2016).

The only effective and widely applied therapy to date for cerebral coenurosis is surgical removal of the cysts under general anaesthesia of the animal; the approach has a very good success rate (75%-90%), especially when the lesion is accurately located (Skerritt and Stallbaumer, 1984; Scott, 2012; Manunta et al., 2012).

To accomplish the operating intervention, a appropiate general anaesthesia is necessary. Neuroleptanalgesia by acepromazine or xylazine, with ketamine ensures a good protection and neuro-vegetative stability and central analgesia. The surgical site for craniotomy must be identified to discover the possible bone softening. Nevertheless, after we get the osseous lambo (by craniotomy) we may note the inequality in its thickness, elements that might guide us to the place where the parasitic bladder is situated.

We note the difference in thickness of the neuro-cranium in the case of the ram. Of the 17 cases, one of them was a male of 3 years of long-wool/Țurcana breed. In this case the craniotomy was more difficult, as the thickness of the bone was more than 3 cm, while in the thickness of the compact mass, the blood vessels are better represented.

During the surgery the haemorrhage is present from the inter-osseous vascularization and epicranial vessels. For a better homeostasis, Vlăduţiu (1966) recommends the administration, 3 hours before the operation, of 10 ml. serum gelatine sol. 5% or Hemosistan in a dose of 10 ml, under skin or intra-muscular with good results. Komnenou et al. (2000) treated surgically 623 cases of coenurosis, cysts were removed successfully at 92% of them and 83% of sheeps were able to return to their flocks, although 36 showed no clinical improvement. An association between *Oestrus ovis* larvae and surgically treated cases of sheep coenurosis has been reported (Heres, 1994). The rapid clinical recovery after surgical removal of the cyst suggests that symptomatology could depend mainly on diffuse or localized increase in intracranial pressure.

The economic impact of dog tapeworms on sheep production is often considered negligible by farmers in comparison to other ovine parasitic infections. The best control and prevention method of coenurosis is to prevent dogs from having access to intermediate hosts carcasses. In addition, the control and prevention of coenurosis should be based on routine anthelmintic dosing of dogs, recommended every six weeks interval with anthelmintic compounds such as praziquantel (Gascoigne and Crilly, 2014). Treating at this interval eliminates the worms before they become sexually mature and, therefore, prevents the shedding of eggs.

Conclusions

The observations made on 17 sheeps diagnosed with cerebral coenurosis and treated by surgical procedure, may lead to the following conclusions:

1. Surgical removal of the coenurus cyst for the treatment of coenurosis cerebralis, is the only efficient therapeutical protocol.
2. Large craniotomy, provides a better exposure of the brain, and facilitates the extraction of the coenurus cyst.
3. Anaesthesia by neuroleptanalgesia confers a good tranquillity during the operation, the operation can be thus performed in field conditions and with excellent results.
4. Treatment based on surgical removal of the coenurus cyst has a very good success rate, especially after accurate localisation of the lesion.

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