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Research - Case report (*peer review*)

Unusual location of *Cysticercus tenuicollis* in the pericardium of an Ouled Djellal ewe from Algeria

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Abstract

Cysticercus (*C.*) *tenuicollis* (metacestode of *Taenia hydatigena*) was found in an unusual location in the pericardium of a three-yearsold Ouled Djellal ewe in Algeria. Postmortem examination revealed the presence of five large cysts (3-5 cm in diameter) in different organs (pericardium, intestine, mesentery, omentum and liver). The ewe was also infected by *Oestrus ovis* larvae and *Sarcocystis sp.* cysts. There is scant information about aberrant locations of *C. tenuicollis* cysts in sheep. Unusual locations of *C. tenuicollis* have been reported to occur in the lungs, kidneys, brain, ovaries, uterine tubes, uterus, cervix, vagina and inside the chorio-allantoic membrane. This is, to our knowledge, the first report of viable *C. tenuicollis* involving the pericardium of an Ouled Djellal ewe.

Keywords: metacestode*, Taenia hydatigena,* cysts, sheep, thoracis cavity

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Introduction

Cysticercosis (*Cysticercus* (*C.*) *tenuicollis* infection) is caused by the metacestode of *Taenia hydatigena*, a tapeworm parasite of dogs, cats and other wild carnivores (Soulsby, 1982; OIE, 2014; Taylor et al., 2016). This metacestode occurs worldwide, mainly in rural areas with large sheep populations (Chege et al., 2016). The infection rates of this cestode in different regions of the world are well known and variable. In Egypt, Brazil, Germany and Australia the infection rates ranged from 11.4 to 19% in sheep (Morais et al., 2016; Omar et al., 2016, Hasslinger and Weber-Werringhen, 1988; Broudbent, 1972). In Turkey and Ethiopia the infection rates are higher, from 56.8 to 65.6% and from 61.6 to 63.9% in sheep and goats, respectively (Utuk and Piskin, 2012; Wondium et al., 2011). In Algeria, C. *tenuicollis* is a common parasite of small ruminants. There is only one study that estimated the prevalence of C. *tenuicollis* in El Tarf region with the infection rate of 24.21% reported by Ouchene-Khelifi and Ouchene (2017). Generally, the infection is asymptomatic; it is only identified in the slaughterhouses (Christodoulopoulos et al., 2008). This parasite causes economic losses due to condemnation of infected offal and meat (Eckert et al., 1984; Singh et al., 2015). Additionally, the parasite causes production decrease and is lethal in heavily infected animals (Abidi et al., 1989). The intermediate hosts become infected after ingestion of proglottids or eggs shed by infected dogs (Senlik, 2008). The oncospheres may remain in the liver or migrate to the omentum, mesenteries and the serosal surface of the peritoneal cavity (Wondium et al., 2011). Mature cysticerci are mainly found attached to the omentum, mesentery, liver and peritoneum (Blazek et al., 1985; Kaufmann, 1996). Unusual locations of *C. tenuicollis* have been reported including the lungs, kidneys, brain, ovaries, uterine tubes, uterus, cervix and vagina (Chege et al., 2016; Zhang et al., 2018). Aberrant location of *C. tenuicollis* within the chorio-allantoic membrane of a goat foetus was also reported (Payan-Carreira et al., 2008). We report herein an unusual location of a viable *C. tenuicollis* cyst attached to the pericardium of an Ouled Djellal ewe from Algeria.

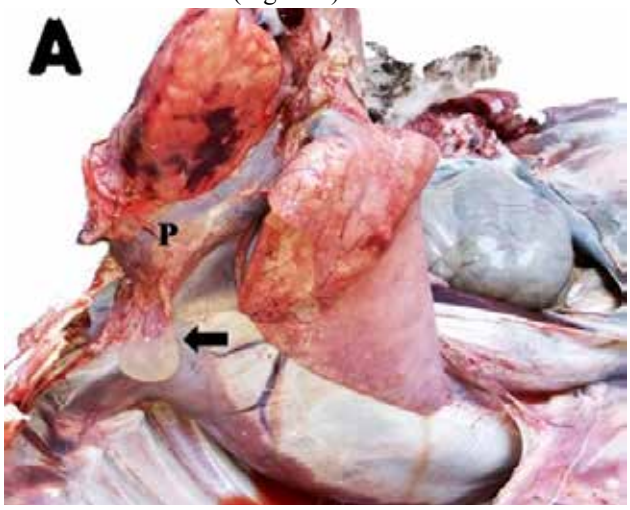
Material and methods

The present case was reported in a sheep from a large semi-intensive sheep herd consisting of approximately 1000 sheep. The farm is located in the Wilaya of Bordj Bou Arreridj (Northeast Algeria). All the animals are dewormed twice a year (winter and summer) with Ivermectine (Zoomectin®; Syva s.a.u, León, Spain) and once a year, during spring, with albendazole (Valbazen® 1.9; Zoetis, Paris, France). The dogs of the farm are not regularly dewormed and many stray dogs are present in the region. A three-years-old emaciated Ouled Djellal breed ewe died, and a *postmortem* examination was performed to determine the cause of death. Nemours cysts were found attached to the heart, intestine, mesentery, omentum and liver. These transparent cysts with clear fluid and with a signal scolex at the anterior end appeared as white non-translucent spot were considered to be *C. tenuicollis* cysts. Tissue samples from the area surrounding the *C. tenuicollis* cysts in the respective organs and from the heart

and tongue were collected. They were fixed in 10% neutral buffered formalin, embedded in paraffin and cut into 5 µm-thick sections and stained with haematoxylin-eosin (HE) for histological examination.

Results

Major findings during necropsy were pleuropneumonia and pericarditis with hydrothorax and petechial haemorrhages of the pleura as well as gastroenteritis. The ewe was also infected by *Oestrus ovis* larvae. Five cysts of C. *tenuicollis* metacestode were found in this case. One cyst of approximately 5 cm in diameter was found in the thoracic cavity attached to the pericardium near the cardiac apex (Figure 1) and three viable cysts of 3 to 4 cm in diameter were attached to the intestine, mesentery and omentum. In the liver, the cyst observed was calcified. Histopatholgical examination revealed necrotizing enteritis in the small intestine (Figure 2).



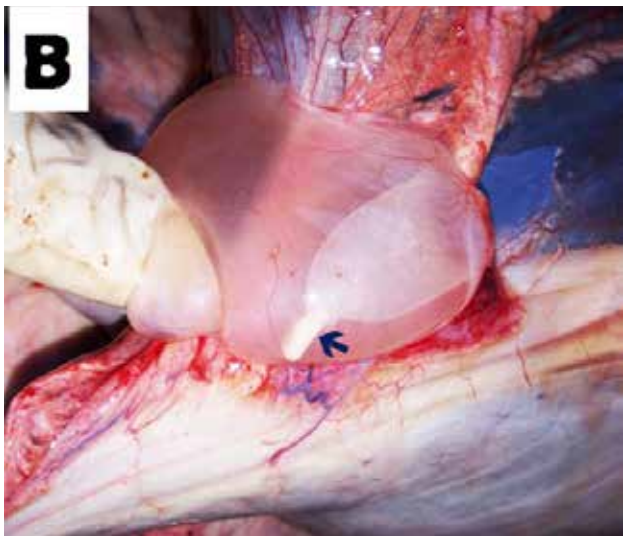


Figure 1. *Cysticercus tenuicollis* cyst (black arrow) attached to the pericardium (P) of an ewe near the apex (A) with a single scolex (blue arrow) (B)

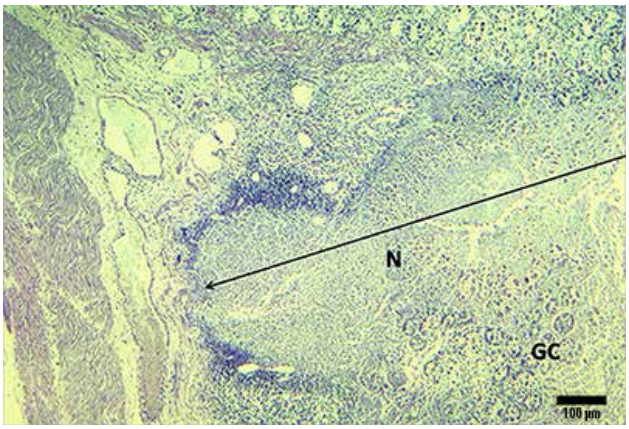


Figure 2. Necrotizing enteritis showing mucosal and submucosal necrosis (N) (arrow) with presence of ghost cell (GC). (H&E, 40X)

Migrated larvae caused traumatic hepatitis with a massive eosinophilic infiltration. No signs of active inflammation were observed in the areas adjoining the cysts (Figures 3 and 4). The tissue samples from the heart and the tongue showed the presence of multiple *Sarcocystis* sp. cysts. It should also be noted that a total of 44 sheep from the same herd were examined post mortem and 15.9% were found positive for *C. tenuicollis.*

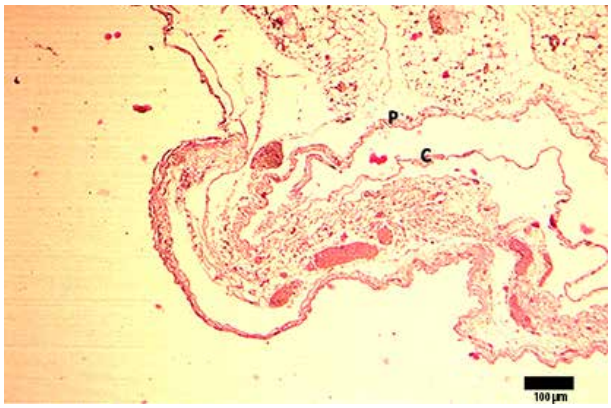


Figure 3. Adhesion of *Cysticercus tenuicollis* (C) to the pericardium (P).(H&E, 40X)

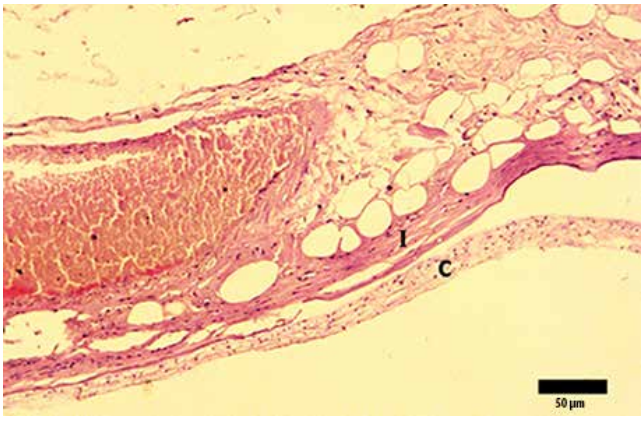


Figure 4. *Cysticercus tenuicollis* (C) attached to the serosa of the small intestine *(I)* . (H&E, 100X)

Discussion and conclusion

Taenia hydatigena is a cosmopolitan cestode occurring in the small intestine of dogs, red foxes, wolves and other wild carnivores (Chege et al., 2016). Metacestodes of *Taenia hydatigena* are present in the peritoneal cavity of sheep, goats, cattle and pigs (OIE, 2014). After hatching in the intestine, the hexacanth embryo reaches the liver *via* the blood stream, passes to the portal vessels and migrates to the peritoneal cavity. Infrequently, they are able to enter the posterior *vena cava,* reach the heart and be transported via the aorta to other parts of the body (Sridhar et al., 1996). All this leads us to presume that the *C. tenuicollis* cyst observed in this case originates from the oncosphere that was carried by blood to the pericardium through different small arteries derived from subclavian artery that receive blade from the aortic arch. Different visceral organs and other organs can be infected with *C. tenuicollis* at different infection rates, but the predominant sites of cysticercus were determined to be omentum and liver, as reported by different authors (Bejiga et al., 2016; Mekuria et al., 2013; Senlik, 2008; Radfar et al., 2005). In the case described herein, the cysts were attached to the pericardium, intestine, mesentery, omentum and liver. The unusual location of *Taenia hydatigena* cysticercosis in the pericardium has been observed only in a lamb (Pellegrini et al., 1981), a 4-year-old Madras Red ewe (Sridhar et al., 1996) and an 8-year-old female Barbari goat (Londhe et al., 2012). No symptoms were noticed because there were no compression or involvement of other structures, or complications. In other hand, the number of the cysts found (5 cysts) is consistent with the data of Senlik (2008) who reported that the number of cysts per animal varied between 1 and 22. The prevalence by age indicated in the literature of *C. tenuicollis* revealed a high infestation of adult animals compared to younger ones, which may be due to high ingestion of eggs of *Taenia hydatigena* by adults and the close contact to the final host (dogs) (Wondium et al., 2011). The three parasites observed in this case, *C. tenuicollis*, *Oestrus ovis* and *Sarcocystis* sp. cause appetite and weight loss. Dubey et al. (2016) reported that in animals suffering from sarcocystosis the immunity was compromised. Nevertheless, it was shown that the oncospheres and cysticerci of other *Taenia* species were able to evade the host immune system to survive (Molinari et al., 2000; Pérez-Torres et al., 2002). We think that these factors associated with the necrotizing enteritis cause the animal death. To the best of the authors' knowledge, this is the first report of pericardiac *C. tenuicollis* cyst in Ouled Djellal ewe form Algeria.

Conflict of interest

The authors declare that they have no financial interest or personal relationships that may have inappropriately influenced them in writing the publication.

References

1. Abidi, S.M.A., Nizami, W.A., Khan, P., Ahmad, M., Irshadullah, M., 1989. Biochemical characterization of *Taenia hydatigena* cysticerci from goats and pigs. J. helminthol., 63, 333-337.
2. Bejiga, T., Haile, A., Solomon, T., Pal, D.S.M., 2016. Prevalence of *Cysticercus tenuicollis* in Small Ruminants Slaughtered at Addis Ababa Abattoir, Ethiopia. World's Vet. J. 6, 137-142.
3. Blazek, K., Schramlová, J., Hulínská, D., 1985. Pathology of the migration phase of *Taenia hydatigena* (Pallas, 1766) larvae. Folia Parasitologica. 32, 127–137
4. Broudbent, D.W., 1972. Ovine cysticercosis and canine taeniasis in Victoria abattoir survey. Aust. Vet. J. 48, 452-455.
5. Chege, S., Toosy, A., Sakr, A., Shawki, A., O'Sullivan, S., de Vargas, A. P., Cavero, T., Islam, A., 2016. Incidental findings of *Cysticercus tenuicollis* metacestodes in five oryx species. Asian Pac. J. Trop. Biomed. 6, 90-92.
6. Christodoulopoulos, G., Theodoropoulos, G., Petrakos, G., 2008. Epidemiological survey of cestode-larva disease in Greek sheep flocks. Vet. Parasitol. 153, 368-373.
7. Dubey, J., Calero-Bernal, R., Rosenthal, B., Speer, C., Fayer, R., 2016. Sarcocystosis of Animals and Humans. CRC Press, Boca Raton, Floride, USA, p. 101.
8. Eckert, J., Gemmell, M.A., Soulsby, E.J.L. and Matyas Z. 1984. Guidelines for surveillance prevention and control of Echinococcosis/ Hydatidosis, 2nd ed., World Health Organisation, Geneva. p. 148.
9. Hasslinger M.A., Weber-Werringhen, A.R., 1988. Fecal survey in pastured sheep and the occurrence of *Cysticercus tenuicollis* in slaughtered sheep. Angew. Parasitol. 29, 227-234. pmid: 2977532
10. Kaufmann, J., 1996. Parasitic infections of domestic animals: a diagnostic manual. Birkhäuser, Basel, Switzerland. p. 101.
11. Londhe, M.S., Tripathi, K.K., Agrawal, R.D., 2012. Cardiac *Cysticercus tenuicollis* in Barbari goat-A case report. Indian J. Vet. Pathol. 36, 92-93
12. Mekuria, E., Shimelis, S., Bekele, J., Sheferaw, D., 2013. Sheep and goats *Cysticercus tenuicollis* prevalence and associated risk factors. Afr. *J.* Agric. Res. 8, 3121-3125.
13. Molinari, J.L., Mejia, H., White, A.C. Jr., Garrido, E., Borgonio, V. M., Baig, S., Tato, P., 2000. *Taenia solium*: a cysteine protease secreted by metacestodes depletes human CD_4 lymphocytes *in vitro*. Exp. Parasitol. 94, 133–142.
14. Morais, D.F.D., Vilela, V.L.R., Feitosa, T.F., Santos, V.M.D., Gouveia, V.R., Athayde, A.C.R. Zevêdo, S.S.D., 2017. Prevalence and risk factors for *Cysticercus tenuicollis* in goats and sheep in Paraíba, northeastern Brazil. Rev Bras. Parasitol. Vet. 26, 235-238.
15. OIE, 2014. cysticercosis. OIE Terr. Man., Chapter 3.9.5. URL. https://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/3.09.05_CYSTICERCOSIS.pdf (accessed 4.2.19)
16. Omar, M.A.E., Elmajdoub, L.O., Al-Aboody, M.S., Elsify, A.M., Elkhtam, A.O., Hussien, A.A. 2016. Molecular characterization of *Cysticercus tenuicollis* of slaughtered livestock in Upper Egypt governorates. Asian Pac. J. Trop. Biomed. 6, 706-708.

17. Ouchene-Khelifi, N.A., Ouchene, N., 2017. Infestation and biochemical content of *Cysticercus tenuicollis* cysts (*Taenia hydatigena* cysts) in sheep and goats. J. Entomol. and Zool. Stud. 5, 822-825
18. Payan-Carreira, R., Silva, F., Rodrigues, M., dos Anjos Pires, M., 2008. *Cysticercus tenuicollis* vesicle in fetal structures: report of a case. Reprod. Domest. Anim. 43, 764-766.
19. Pellegrini, N., Rindi, S., Renzoni, G., Taccini, E., Pambianco, L.A., 1981. On a rare localization by *Cysticercus tenuicollis* in the pericardium of a lamb. Anatomo-histopathological findings and pathogenetic considerations. [Abstract] Annali della Facolta di Medicina Veterinaria di Pisa. 34.
20. Pérez-Torres, A., Ustarroz, M., Constantino, F., Villalobos, N., de Aluja, A.S., 2002. *Taenia solium* cysticercosis: lymphocytes in the inflammatory reaction in naturally infected pigs. Parasitol. Res. 88, 150–152.
21. Radfar, M.H., Tajalli, S., Jalalzadeh, M., 2005. Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cysticerci) from sheep and goats in Iran. Vet. arhiv. 75, 469-476.
22. Senlik, B., 2008. Influence of host breed, sex and age on the prevalence and intensity of *Cysticercus tenuicollis* in sheep. J. Anim. and Vet. Adv. 7, 548–551.
23. Singh, B.B., Sharma, R., Gill, J.P.S., Sharma, J.K., 2015. Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cysts) in sheep and goat from north India. J. Parasit. Dis. 39, 80-84.
24. Soulsby, EJL., 1982. Helminths, arthropods and protozoa of domesticated animals. Bailliere Tindall London, UK, pp. 115
25. Sridhar, R., Manohar, B.M., Shakir, S.A., Sundararaj, A., 1996.. An unusual location of *Cysticercus tenuicollis* in the pericardium of a sheep. Indian Vet. J. 73, 353-353
26. Taylor, M.A., Coop, R.L., Wall, R.L., 2016. Veterinary Parasitology, 4th Edition, John Wiley and Sons, Iowa, USA, p. 487-488.
27. Utuk, A.E., Piskin, F.C., 2012. Molecular detection and characterization of goat isolate of Taenia hydatigena in Turkey. Sci. World J. 2012, 1-4.
28. Wondium, A., Abera, D., Hailu, Y., 2011. A study on the prevalence, distribution and economic importance of *Cysticercus tenuicollis* in visceral organs of small ruminants slaughtered at an abattoir in Ethiopia. J. Vet. Med. Anim. Health. 3, 67–74
29. Zhang, Y., Zhao, W., Yang, D., Tian, Y., Zhang, W., Liu, A., 2018. Genetic characterization of three mitochondrial gene sequences of goat/sheep-derived *Coenurus cerebralis* and *Cysticercus tenuicollis* isolates in Inner Mongolia, China. Parasite. 25, 1

Neobična lokalizacija *Cysticercus tenuicollis* u perikardu Ouled Djellal ovce iz Alžira

Sažetak

Identificirana je neobična lokalizacija *Cysticercus tenuicollis* (metacestoda *Taenia hydatigena*) u perikardu trogodišnje Ouled Djellal ovce u Alžiru. Obdukcija ovce je pokazala prisustvo pet velikih vijabilnih cisti (promjera 3-5 cm) u različitim organima (perikard, crijeva, mezenterij, omentum i jetra). Ovca je također bila inficirana sa larvama *Oestrus ovis* i cistama *Sarcocystis sp.* Informacije o aberantnim lokalizacijama cisti *C. Tenuicollis* kod ovaca su oskudne. Neobične lokalizacije *C. tenuicollis* su opisane u plućima, bubrezima, mozgu, jajnicima, jajovodima, materici, cerviksu, vagini i unutar horio - alantoične membrane. Prema našim saznanjima, ovo je prvi izvještaj o vijabilnom *C. Tenuicollis* u perikardu Ouled Djellal ovce u Alžiru.

Ključne riječi: metacestode, *Taenia hydatigena*, ciste, ovca, grudna šupljina