Short communication

PREVALENCE AND PATHOLOGICAL LESIONS OF
ONCHOCERCOSIS (*ONCHOCERCA FASCIATA*) IN
CAMELS (*CAMELUS DROMEDARIUS*)

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Summary

Farjanikish, G., F. Namazi & M. Rajabloo, 2018. Prevalence and pathological lesions of onchocercosis (*Onchocerca fasciata*) in camels (*Camelus dromedarius*). *Bulg. J. Vet. Med.*, **21**, No 1, 108–114.

The filarial nematode *Onchocerca fasciata* lives as an adult worm, forming well developed fibrous tissue nodules within the fascial sheath of various parts of the camel body. This study was conducted to identify the prevalence and pathology of camel onchocercosis. A total of 298 dromedary camels of both sexes and different ages were examined carefully before and at the time of slaughtering. Twenty nine out of 298 camels (9.73%) were infected with *O. fasciata*. Nineteen out of 156 females (12.17%) and ten out of 142 males (7.04%) were positive. Grossly, one or multiple nodules with 1 to 2.5 centimeters in diameter were observed. The nodules were dry and raised, tactile or hard in their texture. On cross section, tangled masses of thin filarial worms were surrounded by a thick whitish fibrous connective tissue. Maximum number of nodular lesions was found in subcutaneous tissues of the neck, abdomen, hind limbs and other parts of infected camels. The intensity of infection, varied between one nodule and 18 nodules. Histopathologically, multifocal granulomatous inflammatory reactions were observed to be associated with the parasites in the affected areas. Transverse and longitudinal cross sections or fragment of the worms with different degrees of surrounding inflammatory reaction were scattered inside the granulomas.

Key words: camel, histopathology, *Onchocerca*, prevalence

The filarial nematodes *Onchocerca* spp. usually inhabit subcutaneous tissue, ligaments and aponeuroses of large mammals. The parasite was first found in Australian camels by Cleland (1909). The various species are found on more or less specific

sites in the host and may cause the formation of nodules in the connective tissue of their final host. Most of the parasites are harmless (Anderson, 2000). Railliet & Henry (1910) described the species as *Onchocerca fasciata*. *O. fasciata*, a para-

site of connective tissue of abdomen, shoulders, nuchal ligament and the thigh region, is specific for camels (Chhabra & Gupta, 2006).

Onchocercosis is one of the relatively common skin lesions of camels in Saudi Arabia, Iraq, Egypt and Iran (Cheema *et al.*, 1984; Ghandour *et al.*, 1991; El-Massry & Derbala, 2000; Khodakaram-Tafti & Khordadmehr, 2010). Morphological studies were carried out based on the examination of worm portions (Railliet & Henry, 1910). The nodules contain live, degenerated or calcified worms of *O. fasciata*, in addition to inflammatory cells. Although the disease is not of much practical importance, onchocercal nodules, particularly in heavily infected camels, are sometimes mistaken as tubercular, resulting in unnecessary and wasteful condemnation of heavily infected animals. The two conditions can be distinguished by cutting these nodules (El-Massry & Derbala, 2000). Therefore, the present study was conducted to determine the prevalence and pathology of camel onchocercosis in Iran's central desert.

This study was carried out in Tehran and Najaf-Abad (Isfahan Province) from July 2014 until August 2015. A total of 298 camels (156 males and 142 females) of different ages were examined carefully before and at the time of slaughtering. The camels were chosen from apparently healthy animals in a good-to-excellent general condition in the slaughterhouse. Each camel was subjected to careful gross examination for the presence of *Onchocerca* nodules. The subcutaneous fascial sheath of nuchal ligaments as well as other parts of slaughtered camels was examined for presence of *Onchocerca* nodules. The number, distribution and size of these nodules were noted for each animal.

After resection nodules were cut, half of the material was used for morphological studies while the other half was processed for histopathological examination. Half of samples were preserved in ethanol for parasitological study and the other samples were stored in 10% buffered formalin. Ethanol-fixed samples were digested in 2% acidic solution of pepsin (HCl pepsin). The volume of digesting solution depended on the size of examined nodules. Materials were incubated at 37 °C in a water-bath for 4–8 hours. Digested nodules were examined under a dissecting microscope for detection of adult parasites. The worms were fixed in a solution composed of 70% ethanol and 5% glycerin. After fixation, the worms were cleared in lactophenol and mounted in glycerin-gelatin and studied by a light microscope.

Tissue samples for histopathological studies were fixed in 10% neutral buffered formalin, dehydrated in graded ethanol, cleared in xylene, embedded in paraffin wax and sections of 5 µm in thicknesses were stained by haematoxylin and eosin. The morphopathological characteristics of these nodules were noted for each animal.

The statistical analysis was performed using SPSS software version 16 (SPSS, Inc, Chicago, IL). The Chi-square test was used for comparison of the prevalence of onchocerciasis among male and female camels. P values of equal or less than 0.05 were considered statistically significant.

Onchocercal lesions were observed in 29 (9.73%) of examined camels. Nineteen out of 156 females (12.17%) and ten out of 142 females (7.04%) were positive. Maximum number of nodular lesions was found in subcutaneous tissues of the three sides of the neck, abdomen and hind limbs followed by the head, shoulders, elbows and nuchal ligament. The nodules were

Fig. 1. Two nodules (arrows) with 1 to 2.5 centimeters in diameter in the nuchal ligament.

rarely found on the back region of infected animals. The intensity of infection, varied between one nodule and 18 nodules. It was noted that percentage of degenerating worms in nodular lesions was low.

Grossly, one or multiple nodules with 1 to 2.5 centimeters in diameter were observed (Fig. 1). The nodules were dry, raised, tactile or hard in their appearance resembling small lymph nodes. On cross section, tangled masses of thin filarial worms were surrounded by a thick whitish fibrous connective tissue. The adult worms obtained from nodules were identified as *O. fasciata* based on cuticle structure (Fig. 2).

Histopathological examination of tissue sections showed multifocal granulomatous inflammatory reaction around the parasites in the affected areas. Transverse and longitudinal cross sections or fragment of the worms with different degrees of surrounding inflammatory reaction were scattered inside the granulomas (Fig. 3).

The granulomas were composed of thick fibrous walls, the cellular infiltrate of lymphocytes, plasma cells, macrophages and eosinophils. Large acellular areas of coagulative necrosis involving the

parasitic tunnels were seen. Dead microfilariae were scattered in these areas. The fibrous connective tissue spreading from the capsule formed the nodular matrix and several cavities. In some areas, caseous material and dead calcified parasites were easily recognised (Fig. 4).

Fig. 2. Cuticle of adult *Onchocerca fasciata* (Bar=30 μ m).

Fig. 3. Transverse and longitudinal cross sections or fragment of the worms with different degrees of surrounding inflammatory reaction (H&E, Bar=125 μ m).

Fig. 4. In older lesions, caseous material, degenerated and dead calcified parasites are observed in the cavities (H&E, Bar= 250 μ m).

The filarial nematode *O. fasciata* lives as an adult worm, forming well developed fibrous tissue nodules, within the fascial sheath of various parts of the camel body. Recent studies showed that onchocercosis is still seen in different parts of the world (Mtei & Sangha 1990; Achukwi *et al.* 2000; Grillet *et al.*, 2008; Khodakaram-Tafti & Khordadmehr, 2010; Otranto *et al.*, 2012; Anvari Tafti *et al.*, 2015). In the present study, *O. fasciata* was detected in 9.73% of Iranian camels. However, higher

incidence of 15.5% was reported by Cheema *et al.* (1984) and 59% by Nasher (1986) in Saudi Arabia. This variation in prevalence may be due to either their exposure to the insect vector(s) or to greater transmission rate of *O. fasciata* in other countries than in Iran.

To the best of our knowledge, only three studies have been previously reported on *Onchocerca* infection in camels in Iran, which focused only on nodular lesions. Moghaddar & Zahedie (2006)

reported an infection rate of 48% (24 of 50 camels), while Khodakaram-Tafti & Khordadmehr (2010) and Anvari Tafti *et al.* (2015) found that 5.82% (6 of 103) and 11.8% (17 of 144) of camels respectively harboured onchocercal skin nodules.

Furthermore, in this study, maximum number of nodular lesions was found in subcutaneous tissues of the three sides of the neck, abdomen and hind limbs followed by the head, shoulders, elbows and nuchal ligament. These findings are more or less similar to the studies of Moghaddar & Zahedie (2006) and Khodakaram-Tafti & Khordadmehr (2010).

Sex-related effects on prevalence of infection were evaluated. A higher infection rate in female camels was observed than in males. However, Beveridge *et al.* (1979) found that bulls had a higher rate of infection with *O. lienalis* than did the cows. Furthermore, Ladds *et al.* (1979) and Ferenc *et al.* (1986) mentioned that this higher infection rate in bulls was observed only in temperate regions, in which the prevalence was low or moderate. They did not find a difference between bulls and cows in tropical regions, where prevalence of infection with *O. guttarosa* was high. Therefore, a host sex-related factor may be the best indicator when levels of infection are low or moderate. Such data may reflect on the prevalence of infection.

Onchocerca nodules, particularly in heavily infected camels, are sometimes mistaken as tuberculosis infection of lymph nodes. This mistake resulted in condemnation of some carcasses. The two conditions can be distinguished by cutting these nodules. If the nodules reveal filarial nematodes, they could be easily differentiated from suspected lymph nodes that were free upon cutting (El-Massry & Derbala, 2000).

It was interesting to note that *O. fasciata* nodules were confined to the fascial sheath of the ligamentum nuchae and subcutis of other locations of infected camels (El-Massry & Derbala, 2000). The filarial nematodes usually were not visible but could be palpated. In the later stages these nodular lesions were caseated or partly calcified. These results were relatively similar to that of cattle infected with *O. lienalis* (Scholten *et al.*, 1977) and *O. ochengi* (Cross *et al.*, 1997).

Ogundipe *et al.* (1984) reported that in the parasitic cysts, live, dead and calcified tissues were located close to each other. In the present study, the findings of degenerated or calcified cysts located close to each other were compatible with Ogundipe *et al.* (1984) and other studies (Alibaşoğlu *et al.*, 1969; Ogundipe *et al.*, 1984; Specht *et al.*, 2009). Similarly, degenerated or calcified cysts were surrounded by parasitic granulomas containing giant cells, eosinophils, macrophages, lymphocytes and fibroblasts were also compatible with previous findings (Ogundipe *et al.*, 1984).

This study showed that onchocercosis is one of the relatively common skin lesions of camels in Iran. The parasite produces variable pathological changes which often lead to condemnation of infected parts of carcasses in camel meat inspection. The intermediate hosts and vectors are still unknown. Further investigations are needed for detection the intermediate hosts or vectors and possible ways of control and prevention of this disease.

ACKNOWLEDGEMENTS

We are grateful to meat inspectors of Tehran and Najaf-Abad abattoir and slaughterhouse workers for cooperation during the present study.

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- Paper received 07.03.2016; accepted for publication 10.06.2016

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