Prevalence and pathology of *Onchocerca* infection in camels (*Camelus dromedarius*) in central parts of Iran

Anvari Tafti, M.H.[1], Sazmand, A.[2,3], Hekmati Moghaddam, S.[4*], Moobedi, I.[5]

[1]*Department of Parasitology and Mycology, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran*

[2]*Department of Agriculture, Payame Noor University, Tehran, Iran*

[3]*Iranian Research Center for Zoonotic Diseases, School of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran*

[4]*Department of Laboratory Sciences, School of Paramedicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran*

[5]*Department of Medical Parasitology and Mycology, School of Public Health and Institute of Public Health Research, Tehran University of Medical Sciences, Tehran, Iran*

Key words:
Onchocerciasis, one-humped camel, pathology

Correspondence
Hekmati Moghaddam, S.
Department of Laboratory Sciences, School of Paramedicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
Tel: +98(35) 37246541
Fax: +98(35) 37256458
Email: shhekmati2002@yahoo.com

Received: 15 June 2015
Accepted: 21 September 2015

Abstract:

BACKGROUND: Skin lesions of filarial worms are usually common in livestock. In camels, the most reported species is *Onchocerca fasciata*, which involves subcutaneous connective tissue and the nuchal ligament. **OBJECTIVES:** The aim of this study was to investigate the prevalence and pathology of camel onchocerciasis in Iran's central desert. **METHODS:** Carcasses of 144 dromedary camels of both sexes and different ages, slaughtered at the slaughterhouse of three provinces in the central arid parts of Iran, were examined for *O. fasciata* infection. In addition, the blood smears of tested animals were searched microscopically for the presence of microfilariae. **RESULTS:** The results of this study show that seventeen (11.8%) of the tested animals harbored one or multiple nodules containing the worm. Nodular lesions were mainly on the two sides of neck and abdomen. Histopathologically, multifocal granulomatous inflammatory reactions were observed to be associated with the parasites in the affected areas. Transverse and longitudinal sections of the worms were observed within the granulomas. The granulomas were composed of thick fibrous walls, the cellular infiltrate of lymphocytes, plasma cells, macrophages, multinucleated giant cells and eosinophils, associated with different degrees of coagulation necrosis and calcification around the parasites. No positive case was found in blood films. **CONCLUSIONS:** In this study, it was found that onchocerciasis is one of the relatively common skin lesions of camels in Iran. However, parasitemia is not common in the central partsof the country. Histopathologic changes in tissues are quite similar to granulomatous inflammations seen in other cutaneous infections.

Introduction

The *Onchocerca* spp. usually cause the formation of nodules in the connective tissue of their final host. Most of the parasites are harmless. Three species of filarial nematodes

of this genus have been identified in camels (Sazmand et al., 2015). *Onchocerca fasciata*, a parasite of subcutaneous connective tissue and the nuchal ligament, is specific for camels, and has been reported from Africa and Asia. The vector(s) of *O. fasciata* are currently unknown (Determann et al., 1997). Other reported filarial worms, such as *O. gutturosa* and *O. armillata* in camels, are considered to be of bovine origin (Schillhorn Van Veen et al., 1976; El-Sinnary et al., 1981; Holdsworth and Moorhouse, 1985; Hussein et al., 1988). *O. gutturosa* is mainly a parasite of cattle, but has also been found in camels. Its infection site is similar to that of *O. fasciata*. However, camels seem to tolerate this infestation without adverse effects. *O. armillata* develops within the aorta, particularly in cattle (Railliet and Henry, 1910). However, it has also been reported in domestic and wild buffalo, as well as sheep. Studies have shown the presence of this species in the aorta of dromedaries in Nigeria and Sudan (Schillhorn Van Veen et al., 1976; Awad et al., 1990). The worms are often found in nodules in the intima, media and adventitia of the aorta during slaughter. The co-existence of camels and cattle in the same grazing area, a common practice in the aforementioned countries, may facilitate and maintain a high rate of cross-infection between species.

Onchocerciasis, due to *O. fasciata*, has been reported quite frequently in camels in Saudi Arabia, Iraq, Egypt and Iran (Al-Yousif and Hussein, 1994). Onchocerciasis is one of the relatively common skin lesions of camels in Iran (Khodakaram-Tafti and Khordadmehr, 2010). The distribution of nodules is mainly on the two sides of the abdomen, shoulders, nuchal ligament and the thigh region (Chhabra and Gupta, 2006). 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 some carcasses. The two conditions can be distinguished by cutting these nodules. If the nodules reveal filarial nematodes, it could be easily differentiated from the suspected lymph nodes that are free upon cutting. Therefore, the aim of this study was to investigate the prevalence and pathology of camel onchocerciasis in Iran's central desert.

Materials and Methods

In Iran, camels are mainly slaughtered for meat consumption. The dromedaries of the present study were randomly chosen from apparently healthy animals in a good-to-excellent general condition in the slaughterhouses of Yazd, Najaf Abad and Rafsanjan cities located in Yazd, Esfahan and Kerman Provinces, respectively in the central arid parts of Iran.

In the present study, a total of 144 camels (65 males and 79 females) of different ages were inspected carefully before and also at the time of slaughtering for the presence of onchocercal lesions on their skins. Suspected lesions were cut, the biopsy was preserved in physiologic saline solution and sent to the pathology lab within 2h. In the laboratory, they were sectioned to determine the presence of filers. Nearly half of the onchocercal nodules were selected randomly for digestion in 2% HCl-pepsin solution. Digested nodules were examined under a dissecting microscope for the detection of adult parasites for morphological and morphometric study (Cheema et al., 1984). Other nodules and tissue from the affected area were fixed and preserved in 10% formalin solution. Suitable sections through the nodules were cut, fixed in 10% neutral buffered formalin, dehydrated in graded ethanol, embedded in paraffin, sectioned at 5 µm thickness, stained with hematoxylin and eosin, and studied microscopically for adult Onchocerca worms. Tissues surrounding the nodules were also examined for the presence of

microfilariae. In addition, the whole thoracic aorta, brachiocephalic trunk, costocervical and pulmonary arteries, as well as abdominal aorta were examined carefully at the slaughterhouse. In both cases, the vessels were carefully opened with a sharp scissor. Jugular blood sample smears of all infected and non-infected camels were also examined for the presence of microfilariae.

Results

Prevalence rate of infection and distribution of onchocerciasis: Onchocercal nodules were observed in 17 (11.8%) of the 144 examined camels. Maximum number of nodular lesions were found in subcutaneous tissues of the two sides of the neck and abdomen followed by the back region, head, shoulders and elbows. Neither *O. armillata* nor *O. gutorrosa* worms were found in this study.

Macroscopic appearance of lesions: Adult parasites inside *O. fasciata* nodules produced a spectrum of gross pathogenic changes. The nodules were located mainly within the fascial sheath or were slightly pedunculated from it. They were found in the head, nuchal ligament and other parts of infected camels. The fasciae were thickened to form the nodules. The nodules were raised, firm or hard in their texture, ovoid or occasionally flat-topped, and of a button appearance resembling small lymph nodes. The parasites were surrounded by a smooth fibrous tissue capsule. On cutting the specimens, it revealed tangled masses of thin filarial worms. There was an increase in the thickness of the capsule as the lesions grew older. Older nodules showed a grayish core of necrotic tissues in which portions of the worms were found embedded. Occasionally, the parasites appeared thicker than normal as a result of tissue reactions. Calcified worms were also commonly encountered and were easily recognized by their whitish calcareous appearance.

Microfilariae: Microfilariae were recovered from the subcutaneous tissue adjacent to the lesions generally parallel to the location of the nodules containing adult parasites. No microfilarial form was observed in the Giemsa-stained thin blood smears.

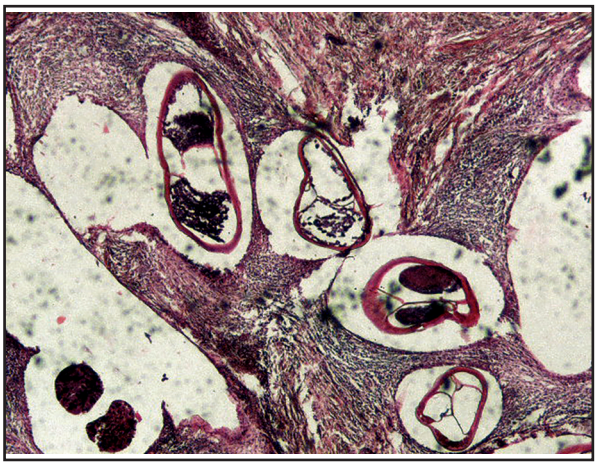

Figure 1. Cross sections of worms within an inflamed fibrous background. Hematoxylin and eosin stain, × 100.

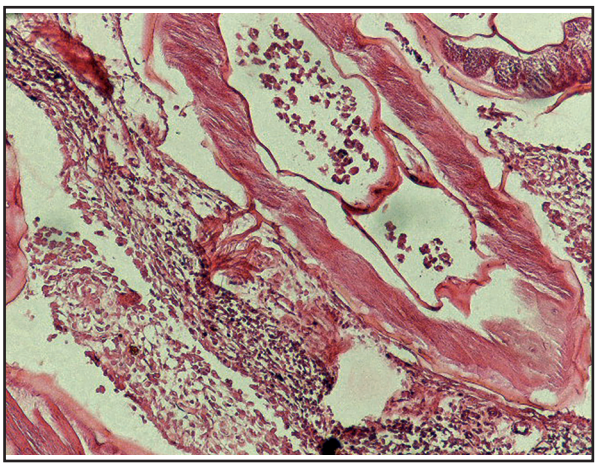

Figure 2. Bicornuate uterus of adult worm, containing eggs. Hematoxylin and eosin stain, × 200.

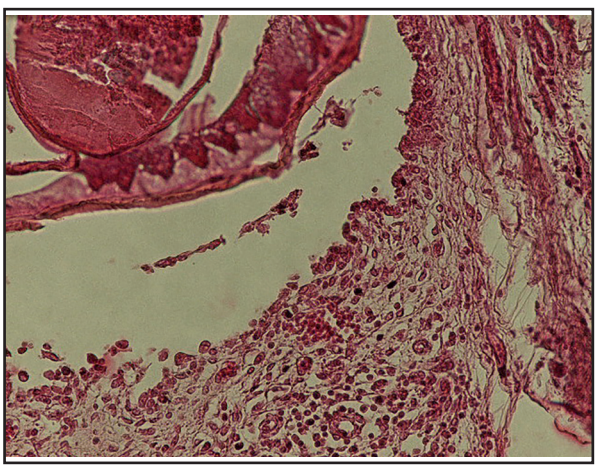

Figure 3. Inflammation around worms and microfilariae. Hematoxylin and eosin stain, × 200.

Histopathological findings: A variety of histopathological alterations were induced by adult worms in tissues, and sometimes multifocal, depending on the duration of the infestation. Fibrous septa spreading from the capsule usually produced several cavities, which contained worm fragments. The transverse and longitudinal sections of the worms are shown in Figure 1. The uterus of worms was filled with embryonated eggs (Fig. 2). Microfilariae were often observable within inflammatory cell infiltration (Fig. 3).

The cells included lymphocytes, histiocytes, eosinophils and plasma cells. In the later stages of the infection, the worms might produce a more severe granulomatous reaction. The dense outer zone comprised of lymphocytes, eosinophils and multinucleated giant cells associated with different degrees of coagulation necrosis and calcification around the parasite. Heavy infiltration by neutrophils occurred in those *Onchocerca* nodules, which contained degenerated or dead worms. The eventual resolution of the worms resulted in the formation of granulated tissue with fibrosis, and finally the calcification of these nodules.

Discussion

In the present study, *O. fasciata* was detected in 11.8% of Iranian camels. However, higher incidence of up to 59% and high intensity has been reported in Saudi Arabia (Nasher, 1988). To the best of our knowledge, only two studies on Onchocerca infection in camels have been reported in Iran, which focused only on nodular lesions, with the exclusion of the aorta and other heart vessels. Moghaddar and Zahedie (2006) reported an infection rate of 48% (24 of 50 camels), while Khodakaram-Tafti and Khordadmehr (2010) found that 5.82% (6 of 103) of camels harbor onchocercal skin nodules.

Furthermore, in this study, nodules were mostly observed in subcutaneous tissues on the two sides of the neck and abdomen, followed by the back region, head, shoulders and elbows. These findings are more or less similar to the studies of Moghaddar and Zahedie (2006) and Khodakaram-Tafti and Khordadmehr (2010).

The results of this study indicated that the location of microfilariae is generally parallel to the location of nodules containing adult parasites. Thus, the existence of microfilariae in mildly infected camels is probably a reflection of nodular distribution in these animals. These results are in line with those obtained by Cheema et al. (1984) and Moghaddar and Zahedie (2006). However, the microfilariae were not recovered from the peripheral blood samples. El-Massry and Derbala (2000) and Moghaddar and Zahedie (2006) also could not observe microfilaria in the blood samples of *O. fasciata* infected animals.

This study did not evaluate sex- and age-related effects on the prevalence of infection, as the parameters were not in the scope of this study. The prevalence rate is said to be higher in young and adult camels than in old camels, although the number, size and weight of nodules per infected animal increases with age. The viability of worms decreases and as the ages of camels increase, degeneration and calcification progresses (Chhabra and Gupta, 2006). Therefore, a host age-related factor may be the best indicator when the levels of infection are low or moderate. Such issues may be reflected in the prevalence of infection.

The *Onchocerca* females were rarely surrounded by males in the detected nodules. Ghandour et al. (1991) could not find any male in the nodules, but Bwangamoi (1969) found that *O. ochengi* females were often surrounded with some male worms in the nodules.

Conclusion: This study showed that onchocerciasis is one of the relatively common skin lesions of camels in Iran, while parasitemia is not common in this area. Histopathologic changes in tissues are quite similar to granulo-

matous inflammations seen in other cutaneous infections.

Acknowledgments

The authors are grateful to the Tehran University of Medical Sciences for the financial assistance.

References

1. Al-Yousif, M., Hussein, H.S. (1994) Onchocerciasis in the Arabian camel (*Camelus dromedarius*) in the Central Region (Riyadh and Qasim Provinces) of Saudi Arabia. Arab Gulf J Sci Res. 12: 361-383.
2. Awad, M.A., Osheik, A.A., Tageldin, M.H., Zakia, A.M. (1990) Note on *Onchocerca armillata* in the Sudanese camel (*C. dromedarius*). A histological and anatomo-pathological approach. Rev Elev Med Vet Pays Trop. 43: 345-348.
3. Bwangamoi, O. (1969) *Onchocerca ochengi new* species, an intradermal parasite of cattle in east Africa. Bull Epizoot Dis Afr. 17: 321–335.
4. Cheema, A.H., El-Bihari, S., Ashour, N.A., Ali, A.S. (1984) Onchocercosis in camels (*Camelus dromedarius*) in Saudi Arabia. J Helminthol. 58: 279-285.
5. Chhabra, M.B., Gupta, S.K. (2006) Parasitic diseases of camels-an update, 2. Helminthoses. J Camel Pract Res. 13: 81-87.
6. Determann, A., Mehlhorn, H., Ghaffar, F.A. (1997) Electron microscope observations on *Onchocerca ochengi* and *O. fasciata* (Nematoda: Filarioidea). Parasitol Res. 83: 591-603.
7. El-Bihari, S. (1985) Helminths of the camel: A review. Br Vet J. 141: 315-326.
8. El-Massry, A.A., Derbala, A.A. (2000) Evidence of *Onchocerca fasciata* (Filaroidea: Onchocercidae) in camels (*Camelus dromedarius*): 1- Prevalence, nodular lesions appearance and parasite morphology. Vet Parasitol. 88: 305-312.
9. El-Sinnary, K., Hussein, H.S. (1981) *Onchocerca gutturosa* (Neumann) in camels (*Camelus dromedarius*) in the Sudan. Ann Trop Med Parasit. 75: 469-470.
10. Ghandour, A.M., Al-Amoudi, A.A., Banja, A.A. (1991) *Onchocerca fasciata* and its nodule development in camels in Saudi Arabia. Vet Parasitol. 39: 67-77.
11. Holdsworth, P.A., Moorhouse, D.E. (1985) *Onchocerca gutturosa* in an Australian camel. Aust Vet J. 62: 201-202.
12. Hussein, H.S., Atta el Mannan, A.M., El Sinnary, K. (1988) *Onchocerca armillata* and *Onchocerca gutturosa* in camels (*Camelus dromedarius* L.) in the Sudan. Vet Res Commun. 12: 475-480.
13. Khodakaram-Tafti, A., Khordadmehr, M. (2010) Gross and histopathological lesions of onchocercosis in camels (*Camelus dromedarius*). J Camel Pract Res. 17: 37-39.
14. Moghaddar, N., Zahedie, A. (2006) Prevalence and pathogenesis of *Onchocerca fasciata* infection in camels (*Camelus dromedarius*) in Iran. J Camel Pract Res. 13: 31-35.
15. Nasher, A.K. (1986) Incidence and intensity of *Onchocerca fasciata* Railliet and Henry, 1910 in local camels in Saudi Arabia. Ann Parasitol Hum Comp. 61: 77-80.
16. Railliet, A., Henry, A. (1910) Le onchocerques, nematodes parasites due tissu conjonctif. C R Soc Biol Paris. 151: 248–251.
17. Sazmand, A., Eigner, B., Mirzaei, M., Hekmatimoghaddam, S., Harl, J., Duscher, G.G., Fuehrer, H.-P., Joachim, A. (2015) Molecular identification and phylogenetic analysis of *Dipetalonema evansi* (Lewis, 1882) in camels (*Camelus dromedarius*) of Iran. Parasitol Res. DOI: 10.1007/s00436-015-4896-y.
18. Schillhorn Van Veen, T.W., Bello, S.I., Folaranmi, D.O.B. (1976) *Onchocerca armillata* Railliet and Henry, 1909 from a new host, *Camelus dromedari*. Rev Elev Med Vet Pays Trop. 29: 227-228.
19. Wernery, U., Kaaden O.R. (2002) Infectious Diseases in Camelids. Blackwell Wiss. –Verl. Berlin; Vienna.

مجله طب دامی ایران، ۱۳۹۴، دوره ۹، شماره ۴، ۲۶۱-۲۵۷

شیوع و آسیب شناسی آلودگی به اونکوسرکا فاسیاتا در شترهای بخش‌های مرکزی ایران

محمدحسین انوری تفتی[۱] علیرضا سازمند[۲،۳] سیدحسین حکمتی مقدم[۴*] ایرج موبدی[۵]

۱) گروه انگل شناسی و قارچ شناسی، دانشکده پزشکی دانشگاه علوم پزشکی شهید صدوقی یزد، یزد، ایران
۲) گروه کشاورزی، دانشگاه پیام نور، یزد، ایران
۳) مرکز تحقیقات بیماریهای زئونوز ایران، دانشکده بهداشت دانشگاه علوم پزشکی شهید صدوقی یزد، یزد، ایران
۴) گروه علوم آزمایشگاهی، دانشکده پیراپزشکی دانشگاه علوم پزشکی شهید صدوقی یزد، یزد، ایران
۵) گروه انگل شناسی و قارچ شناسی، دانشکده پزشکی دانشگاه علوم پزشکی تهران، تهران، ایران

(دریافت مقاله: ۲۵ خرداد ماه ۱۳۹۴، پذیرش نهایی: ۳۰ شهریور ماه ۱۳۹۴)

چکیده

زمینه مطالعه: ضایعات پوستی حاصل از آلودگی با کرم‌های نخی شکل در حیوانات شایع است. در شترها، بیشترین گونه گزارش شده اونکوسرکا فاسیاتا می‌باشد که به بافت پیوندی زیرپوست و رباط نوکال آسیب می‌رساند. **هدف:** در مطالعه حاضر شیوع و آسیب شناسی انکوسرکیازیس در شترهای کویر مرکزی ایران مورد بررسی قرار گرفت. **روش کار:** لاشه‌های ۱۴۴ نفر شتر یک کوهانه از سنین مختلف و هر دو جنس در کشتارگاه‌های سه استان در نواحی نیمه خشک مرکز ایران جهت بررسی آلودگی به اونکوسرکا فاسیاتا مورد آزمایش قرار گرفتند. همچنین گسترش خونی از شترها برای بررسی وجود میکروفیلاریای انگل مورد آزمایش میکروسکوپی قرار گرفت. **نتایج:** ۱۷ نفر از حیوان ات مورد آزمایش (۱۱/۸٪) به یک یا چند ندول حاوی انگل آلوده بودند. ضایعات بیشتر در دو طرف گردن و ناحیه شکمی مشاهده شد. نتایج هیستوپاتولوژی نشان گر واکنش‌های التهابی گرانولوماتوزی چند کانونی در اطراف انگل‌ها در محل آلودگی بود. مقاطع عرضی و طولی کرم‌ها در گرانولوماها مشاهده شد. گرانولوماها از دیواره‌های فیبروزی ضخیم، فیلتراسیون سلولی لمفوسیت‌ها، پلاسما سل‌ها، ماکروفاژها، گران یاخته‌های چند سلولی و ائوزینوفیل‌ها مرتبط با درجات مختلف نکروز انعقادی و کلسیفیکاسیون در اطراف انگل تشکیل شده بود. هیچ مورد مثبت در گسترش‌های خونی مشاهده نشد. **نتیجه‌گیری‌نهایی:** اونکوسرکیازیس یکی از شایع‌ترین ضایعات پوستی شترها در ایران است، اگرچه پارازیتمی در نواحی مرکزی کشور شایع نیست. تغییرات هیستوپاتولوژیک در بافت‌ها تقریباً شبیه التهاب‌های گرانولوماتوزی در دیگرعفونت‌های پوستی می‌باشد.

واژه‌های کلیدی: اونکوسرکیازیس، شتر یک کوهانه، آسیب شناسی

---

*) نویسنده مسؤول: تلفن: ۳۷۲۴۶۵۴۱ (۳۵)۹۸+ نمابر: ۳۷۲۵۶۴۵۸ (۳۵)۹۸+ Email: shhekmati2002@yahoo.com