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Case Report

Nymphal Linguatulososis in Indian Crested Porcupines (*Hystrix Indica*) in Southwest of Iran

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Abstract

Linguatula serrata is one of the important zoonotic parasites. Carnivores serve as definitive host. The larvae existed in mesenteric lymph nodes (MLNs), liver, lungs, etc of intermediate herbivores. The definitive host becomes infected by ingesting viscera containing the infective nymphal stage. Humans may be infected with *Linguatula* either by ingestion of nymphs resulting in a condition called nasopharyngeal linguatulososis or Halzoun syndrome or by ingestion of infective eggs which develop in internal organs resulting in visceral linguatulososis. Indian crested porcupine (*Hystrix indica*) is a common rodent in Middle East. Based on some tradition, consumption of *Hystrix* meat and viscera is common in some parts of Iran. The present study reports the occurrence of *Linguatula serrata* nymph in *H. indica* as a new intermediate host from southwest of Iran.

Keywords: Nymphal linguatulososis, *Linguatula serrata*, Indian crested porcupine, Rodent host

Introduction

Linguatula serrata is one of the important zoonotic parasites. Adults inhabit in respiratory system of canine (final hosts). Infective eggs containing larvae are discharged into the environment by nasopharyngeal secretions or coughed up, swallowed, and passed out of the host in the feces. When suitable intermediate host (herbivorous animal), swallows these eggs, the larvae migrate to mesenteric lymph nodes (MLNs), liver, lungs, etc. After six to nine molting, the nymphs are infective for final host. Canine become infected by ingesting viscera containing the infective nymphal stage. The parasite is tongue-shaped, lightly convex dorsally and flattened ventrally. Males measure 1.8–2 cm, while females measure 8–13 cm in length (Soulsby 1982).

Humans may be infected with *Linguatula* either by ingestion of nymphs resulting in a condition called nasopharyngeal linguatulososis or Halzoun syndrome or by ingestion of in-

fective eggs which develop in internal organs resulting in visceral linguatulososis (Shekarfroush et al. 2004). Halzoun syndrome may arise via consumption of raw or undercooked liver and lymph nodes.

The syndrome has been reported in many countries including Africa, South-East Asia and the Middle East (Beaver et al. 1984, Drabick 1987, El-Hassan et al. 1991). Some researchers described clinical signs of the syndrome including pharyngitis, salivation, dysphagia and coughing. Visceral linguatulososis generally remains asymptomatic (Khalil and Schacher 1965, Yagi et al. 1996). Clinical signs associated with infections in intermediate hosts have not yet been described carefully (Mehlhorn 2008). There are reports of linguatulososis in other organs such as eye (Lazo et al. 1999). The prevalence of *L. serrata* have been studied in various animals in Iran, including dogs (Meshgi and Asgarian

2003, Oryan et al. 2008, Rezaei et al. 2011), sheep (Shekarforoush et al. 2004, Nourollahi Fard et al. 2011), goats (Razavi et al. 2004), camels (Shakerian et al. 2008, Radfar et al. 2010, Rajabloo et al. 2011, Oryan et al. 2011, Rezaei et al. 2012, Bamorovat et al. 2013) and cattle (Hami et al. 2009, Tajik et al. 2011). There are also some reports of human linguatulosis in Iran (Sajjadi et al. 1998, Maleki 2001, Anaraki Mohammadi et al. 2008, Tabibian et al. 2012).

The Indian crested porcupine (*Hystrix indica*) has been distributed in Iraq, Iran, Palestine, Syria, Lebanon, Turkey, southern and eastern states of the former Soviet Union and Indian subcontinent (Arsalan 2008). *Hystrix indica* is nocturnal and spend daylight hours in natural caves or excavated burrows. Porcupines consumed storage organs of at least twelve species of geophytes and hemicryptophytes and ate potatoes, peanuts, peppers, fallen fruit, and other agricultural crops (Alkon and Saltz 1988).

The present study reports the occurrence of *L. serrata* nymph in *H. indica* from southwest of Iran.

Case Report

During a six month period, September 2012 to March 2013, the carcasses of two *H. indica* were transferred to Department of Pathobiology, School of Veterinary Medicine, Shiraz University, Shiraz, Iran. One of them was died in September 2012, when it was crossing the road in Bamu National Park (29° 40 20.52 N, 52° 46 1.21 E), Shiraz, Iran, and the other carcass was confiscated from unauthorized hunters. The animals were necropsized systematically. The body cavity was opened by a longitudinal incision from throat to vent. Mesenteric and mediastinal lymph nodes and liver were collected from each animal, cut into small pieces and massaged in tepid water and left for 30 minutes

to allow nymphs to come out from tissue. The livers were sliced in 4–5 mm thick and observed carefully to find the encapsulated or free nymphs. The samples were examined for the presence of nymphs using a stereomicroscope. Recovered nymphs were fixed in ethanol 70%, slightly pressed between two flat glasses. They were stained with carmine and then mounted in Canada balsam® as permanent slides. Measurements of morphological features were made with a light microscope using a calibrated ocular micrometer. Samples (liver, MLNs, and mediastinal lymphatic nodes) were studied separately. In the case of liver, no nymphal stage was found. The results were also negative for mediastinal lymphatic nodes of both animals but the MLNs were infected with 12 and 8 *L. serrata* nymphs. Based on morphologic characteristics, the parasite was identified as the nymphal stage of *L. serrata* (Fig. 1).

The parasites were tongue-shaped, segmented and covered with several spines in linear arrangement. Total body length was 52 ± 3 mm, the body width was 1.2 ± 1 mm in anterior and 0.25 ± 0.02 mm in posterior ends. The hooklets surround elliptical mouth.



Fig. 1. Nymphs of *L. serrata* recovered from mesenteric lymphatic nodes of *H. indica*, stained with carmine (A×4, B×40)

Discussion

Canine are definitive hosts and the herbivores such as sheep, goat, cattle and camel act as intermediate host in life cycle of *L. serrata*. Cats (Esmailzadeh et al. 2008), fox

(Gicik et al. 2009), dingo, *Canis lupus dingo*, *Chrysocyon brachyurus*, *Procyon cancrivorus cancrivorus* and wolf, *Canis lupus lupus* can also be definitive hosts (Christoffersen and De Assis 2013), *L. serrata* nymphs were found in European porcupine *Hystrix (Hystrix) cristata*, degu, *Octodon degus*, common hare, *Lepus (Eulagos) europaeus europaeus* [as *Lepus europaeus*] and common rabbit, *Oryctolagus cuniculus cuniculus* [as *Lepus cuniculus*]. (Christoffersen and De Assis 2013). It has been found commonly in cottontail rabbits (*Sylvilagus floridanus*) in the USA (Moore and Moore 1947). *Linguatula* sp. is maintained in Australia by a fox-rabbit cycle since foxes, not dogs, have been found infested (Pullar 1946). Our study revealed that *H. indica* can be regarded as another intermediate host for this parasite and a sylvatic cycle between porcupine and carnivores may exist in Fars Province.

The prevalence rate of nymphal stages was studied by many researchers in variety of hosts. Shekarforoush et al. (2004) reported a prevalence of 11.5% and 3% in the mesenteric lymph nodes and liver of sheep, respectively and Razavi et al. (2004) recorded 29% infection in the mesenteric lymph nodes and 6% in the livers of goats in Shiraz area, Fars Province, southern Iran. Prevalence rates of nymphal linguatulosis in one-humped camels were reported 12.9% in Yazd (Oryan et al. 2011), 64% in Tehran (Rajabloo et al. 2011), 20.5% in Rafsanjan (Bamorovat et al. 2013), 21.12% in Isfahan (Rezaei et al. 2012), 21.0%, 4.5% in MLNs and liver respectively, in Najaf-Abad (Shakerian et al. 2008). It has also been reported from two-humped camel (*Camelus bactrinus*) in Tabriz, Iran (Haddadzadeh et al. 2009). The Prevalence rates in sheep were 16.1% in Kerman (Razavi et al. 2004) and 11.5 % and 3% in MLNs and liver, respectively, in Shiraz (Shekarforoush et al. 2004). In goat, the prevalence rates were reported 29.9% and 6.4% in MLNs and liver, respectively in

Shiraz (Razavi et al. 2004) and in cattle, 44% in Urmia and 0.25% in Tabriz (Hami et al. 2009). It seems that the parasite is common among herbivores and canine in Iran. Halzoun syndrome was reported from Shiraz (Sajjadi et al. 1998), Tehran (Maleki 2001, Anaraki Mohammadi et al. 2008) and Isfahan (Tabibian 2012). All of these reports showed the high rate of infection in both definitive and intermediate hosts in various parts of Iran and it is not unexpected to consider a canine-porcupine sylvatic cycle in this region.

The parasite has been reported from human beings in Iran (Sajjadi et al. 1998, Maleki 2001, Anaraki Mohammadi et al. 2008), Austria (Koehsler et al. 2011), Morocco (Le Corroller and Pierre 1959) and Turkey (Yilmaz et al. 2011). These reports showed zoonotic importance of infection.

Hystrix indica is a common rodent in Iran. It fed from potatoes, peanuts, peppers, fallen fruit, and other agricultural crops and classified as an herbivore rodent (Alkon and Saltz 1988, Arsalan 2008). Infection of MLNs suggests a similar migration and life cycle of the parasite in this animal. With our knowledge there is no report about nymphal linguatulosis in Indian crested porcupine species but it has been reported from lungs of European porcupine *Hystrix (Hystrix) cristata* (Linnaeus 1758).

One part of the porcupine is always a delicacy the liver, which is easily removed by making a cut just under the neck into which the hand is thrust, and the liver pulled out. It may be fried with bacon, or baked slowly and carefully in the baker-pan with slices of bacon (Kephart 2001). Many locals relish the porcupine's meat (Al Nees) as a delicacy and for medicinal purposes. Perhaps this is responsible for the decline of *H. indica* population throughout Jordan (Amr et al. 2014). Consumption of *Hystrix* meat and viscera has been observed among native people for medicinal purposes in south and west of Iran (personal observation).

Oryan et al. (2008) reported a prevalence of 76.5% in stray dogs in Shiraz, southwest of Iran. The Prevalence of adult stage has also been reported 27.83% in North West (Rezaei et al. 2011) and 62.2% in central part of Iran (Meshgi and Asgarian 2003).

Stray dogs and other wild canines can hunt porcupine and this animal can be a part of their diets. Our study revealed that porcupine can act as an intermediate host for sylvatic cycle of the parasite in this area. These facts showed that the sylvatic cycle could support the distribution of *L. serrata*. Further investigations are needed to be carried out to clarify the exact role of canine and other wild rodents in the life cycle of *L. serrate*.

Conclusion

In conclusion, our results and high prevalence of linguatulososis in both definitive and intermediate host in Fars Province showed that sylvatic cycle should be considered as a risk factor for human beings and other hosts.

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The authors declare that there is no conflict of interests.

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