



# Investigation of histopathological changes caused by adult stage of *Linguatula serrata* in dog

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## Abstract

*Linguatula serrata*, known as tongue worm, is an anomalous ubiquitous parasite. This parasite inhabits the canine respiratory system as its final host. The discharged eggs cause to contamination of many plants that are consumed by feeder animals including human causing visceral and nasopharyngeal linguatulosus that is known as “Marrara syndrome.” This research was conducted for the first time to investigate the distribution and pathological findings of *L. serrata* adult in nasal cavity of road-killed dogs in Uremia, Iran. For doing so, 52 dogs were inspected. During the necropsy; *L. serrata* adult was seen in 1 (1.92%) out of 52 dogs. The histopathological findings depicted lymphocytes and some eosinophils infiltration in lamina propria.

**Keywords** *Linguatula serrata* · Dog · Histopathological

## Introduction

*Linguatula serrata* is a zoonotic parasite with worldwide outbreak. This parasite is seen in the final hosts’ nasopharyngeal mucosa mostly. The grazing herbivores and also human, as intermediate hosts, can ingest the nasopharyngeal secretion discharged eggs. The larvae move into the mesenteric lymph nodes, liver, and lung, then they can enter into the infective nymphs (Hendrix 1998). If the final host eats the infected organs, it will be developed to the adult form and reminded in the nasal cavity such as mucosal membrane, nasal passage, frontal sinuses, and turbinates, over 6-month period and many eggs will be produced (Aldemir et al. 2014; Taşan 1987). Seems like the adult

parasites of *L. serrata* takes nourishment from respiratory mucosal cells and blood. They cause respiration impairment, sneezing, slight nasal discharge, and inflammation after growth. The prevalence of *L. serrata* in dogs have been probed in numerous studies (Ionita and Mitrea 2016; Mitchell et al. 2016; Oluwasina et al. 2014; Aldemir 2004; Meshgi and Asgarian 2003; Oryan et al. 2008). Ingestion of the undercooked meal which is infected by nymph of the parasite causes infection in human. The ingested nymph can appear from their cysts and fasten on the mucosal epithelium with protuberant hooks. This phenomenon results in various respiratory and gastrointestinal signs and symptoms are named marrara or halazoun syndrome (Khalil and Schacher 1965; Morsy et al. 1999; Papadakis and Hourmouziadis 1958; Sulyok et al. 2014; Yazdani et al. 2014; Yilmaz et al. 2011). Although several studies have been done on the pathological changes of mesenteric lymph nodes contaminated by nymphs in intermediate hosts (Al-Sadi and Ridha 1994; Aldemir et al. 2014; Tavassoli et al. 2007; Yakhchali and Tehrani 2011; Yakhchali and Tehrani 2013; Young 1975), little information has been obtained on the pathological changes on adult form of *L. serrata* in dogs (Villedieu et al. 2017; Bordicchia et al. 2014). However, this research aimed at investigating the pathological changes in nasopharyngeal cavity of the infected dog.

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## Material and methods

### Collection of the sample

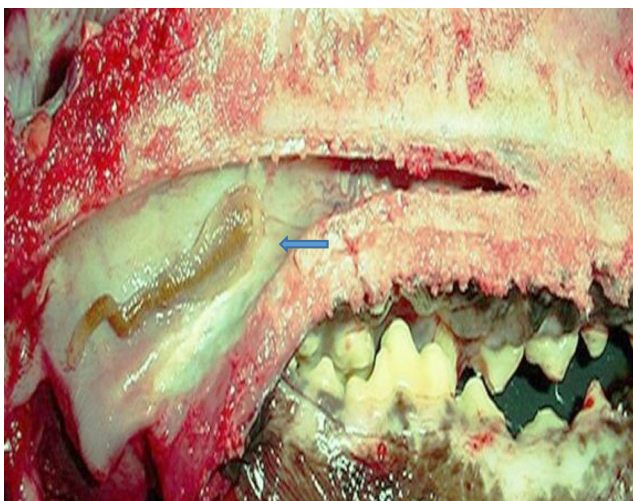
This research was carried out on road-killed dogs in Urmia (Iran) from March 2015 to September 2015. After obtaining the Environment Agency and Bureau veterinary of Tabriz and Urmia permission (Letter Number 2312), the corpses of 52 dogs were collected and transferred to the Veterinary Parasitology Laboratory, Faculty of Veterinary Medicine, Urmia University, Urmia, Iran. Some characteristics such as age (based on their teeth condition) were recorded for each dog (Sisson and Grossman 1975).

### Parasitological and histopathological procedures

The carcasses were moved to autopsy room; their skin was dissected and their skull was split via a thin hacksaw. Then, the nasopharyngeal area, nasal turbinates, paranasal sinuses, eustachian tubes, trachea, and brain were inspected for existence of adult form of *L. serrata* and the parasites were gathered. In order to conduct the histopathological examination, the contaminated tissue samples were immersed in 10% phosphate-buffered formalin (PBF) for at least 24 h for fixation. The samples were embedded in paraffin after conducting fixation. Then, 5- $\mu$ m sections were prepared from each paraffin block and stained by hematoxylin and eosin (H & E) method.

## Result

Among total 52 examined dogs, a 3-year-old dog (1.92%) was reported as infected with *L. serrata* attaching to the nasal tract mucosa (Fig. 1). The infected dog nasal tract, turbinates, and sinuses were soft and edematous with focal ulceration and

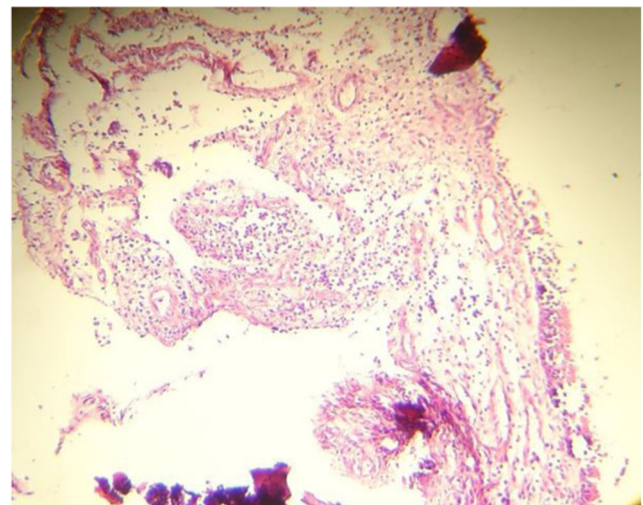


**Fig. 1** Adult form of *L. serrata* (female) harvested from infected dog

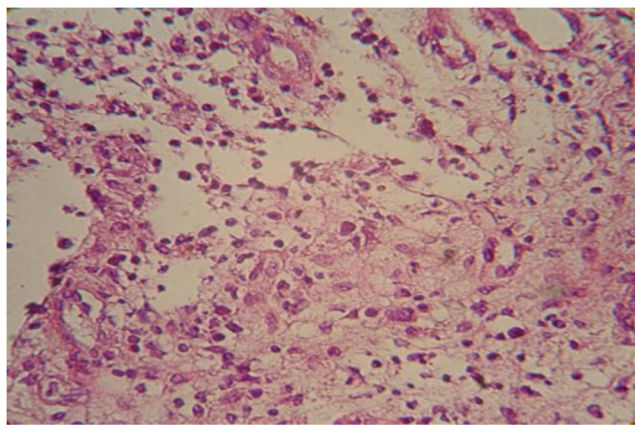
hemorrhagic. The microscopic examination revealed lymphocytes and some eosinophils infiltration in lamina propria (Figs. 2, 3, and 4).

## Discussion

Linguatulosis is important in veterinary and public health scope all over the world, particularly in Iran. The dogs linguatulosis was reported from various regions of Iran (Meshgi and Asgarian 2003; Oryan et al. 2008; Rezaei et al. 2011). In other countries especially in neighbor countries such as Turkey, the parasites were removed from dogs considered as final host. (Akyol et al. 1995). This research was conducted in order to examine the tissue sections histologically. The section includes nasal cavity resinitis, allergic rhinitis, infiltration of lymphocytes, and eosinophils in lamina propria. The observed histopathological changes were similar to the cases reported by Oryan et al. (2008). They studied the adult form of *L. serrata* pathological changes in dogs and found that vast majority of parasites were present in the posterior region of nasopharynx and nasal turbinates. The examined dogs depicted low infection rate and less tissue reaction in the nasal and frontal tract. The soft, edematous, necrotic, ulcerated, and hemorrhagic nasal tract, nasal turbinates, and sinuses were reported in some of the infected dogs with high infection rate. Catarrhal rhinitis, hyperplasia of goblet cell, hypertrophy of submucosal gland, necrosis, and desquamation of the epithelial cells as well as increased fibrous connective tissues in lamina propria of turbinates were also reported in the infected dogs. The macrophages, lymphocytes, plasma cells, and eosinophils were infiltrated differently in subepidermal regions and lamina propria of the dogs with severe infection. Bordicchia et al. (2014) found a

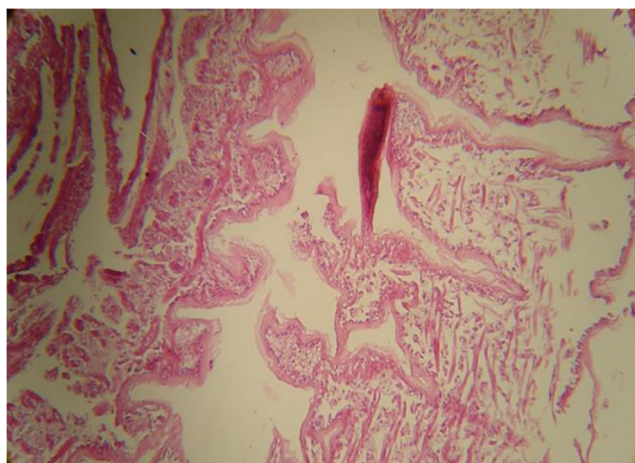


**Fig. 2** Showing nasal tract mucosa of infected dog infiltrated by lymphocytes and polymorphonuclear inflammatory cells within epithelium and lamina propria (H & E,  $\times 10$ )



**Fig. 3** Higher magnitude of previous figure showing lymphocytes and eosinophils (black arrow) in lamina propria (H & E, × 40)

nasal carcinoma in a dog with *L. serrata* infection. Aldemir et al. (2014) examined the pathology of the *L. serrata* nymphs in mesenteric lymph nodes (MLNs) of the sheep and showed that these nodules were surrounded by infiltration of mononuclear cells and neutrophils. Lymphoid follicles also depicted reactive changes. Yakhchali and Tehrani (2011) investigated the pathological changes in mesenteric lymph nodes infected with *L. serrata* nymphs in sheep and showed granulomatous inflammation with giant cells, macrophages, edema, necrosis, and lymphocytic infiltration associated with cystic changes. The mesenteric lymph node histopathological examination in sheep infected with immature stages of *L. serrata* disclosed severe and chronic inflammation along with existence of bacterial colonies and fungal elements (Miclaus et al. 2008). The infection by *L. serrata* can be found in human. Taba Taba et al. (2012) found *L. serrata* infection in MLNs of a 55-year-old man presented by abdominal pain and diverticulosis. In a research by Pampiglione et al. (2001), a pulmonary nodule was reported due to *L. serrata* in an HIV-positive man residing in Bari, Southern Italy, during a routine X-ray examination. A scarce case of liver granuloma caused



**Fig. 4** Cut section of harvested *L. serrata* attached to sinusal mucosa (H & E, × 20)

by a nymph of *L. serrata* in a woman in Michigan, USA, was pointed by Gardiner et al. (1984). A calcified nodule was reported in liver of a 62-year-old man in North Carolina, USA, including a deteriorated nymph of *L. serrata*. (Baird et al. 1988). Generally, comparison of this research results in similar studies on various stages of *L. serrata* in animals and also human cases depicted similar histopathologic changes.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. We permitted from the Environment Agency and Bureau veterinary of Tabriz and Urmia (Number Letter 2312). This article does not contain any studies with human participants performed by any of the authors.

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