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Short Communication

Heavy Worm Burden of *Moniliformis moniliformis* in Urban Rats with Histopathological Description

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ABSTRACT

Background: Due to scarcity of human reports, we took advantage of the heaviest infection of *M. moniliformis* in rats, to describe histopathological and microanatomical valuable useful keys while confronting human occurrences.

Methods: Samples were obtained from captured rats in Tehran, capital of Iran, during two decades. Tissue sections were performed through hematoxylin and eosin staining to describe histopathological changes in rat's intestines.

Results: Totally, nine rats were found infected with *M. moniliformis* amongst 272 obtained rats. Heavy infection has been distinguished in 2 individuals with parasite burden of 141 and 73 adult worms. Cross sections of worms within the lumen show mucosal thickness, infiltration of eosinophilic leukocyte and increase in goblet cells.

Conclusion: Beyond the uncommonness of human infection with *M. moniliformis* unintended infections should not be ignored. Abundance of rats and roaches as definite and intermediate hosts must be considered particularly in countries with poor hygiene.

Keywords: Acanthocephala, *Moniliformis moniliformis*, Histopathology, Rats

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Introduction

Without exception, all members within the phylum Acanthocephalans are biologically parasites. These pseudocoelomates diocious endoparasites take advantage of arthropods as invertebrate intermediate host to complete their lifecycle. However, a few species are of the medical and veterinary importance, where heavy infection might cause morbidity and mortality (1).

Moniliformis and *Macracanthorhynchus* are two genera capable of causing human acanthocephaliasis (2). Both helminthes are considered as perforating acanthocephalans since they may cause intestinal perforation in their final hosts, which can be facilitated by the worm's proteolytic enzymes (3). Wide range of mammals including rats is susceptible to acquire *Moniliformis moniliformis* as definitive hosts (4). Rats with their cosmopolitan distribution, not only threatening different aspects of public health generally but also are known to carry several zoonotic parasites even in developed countries (5). To realize the importance of acanthocephalan transmission, the great abundance of different capable biological vectors around human environment is worth mentioning.

Cockroaches are appropriate vectors to develop the eggs of *Moniliformis* sp. into infective form of transmittable cystacant to vertebrate final hosts (6).

Although the pathological changes due to harboring acanthocephalan and consequent bacterial infection have already described (1), more details on histopathology and microanatomy of rat intestinal involvement to *M. moniliformis* is illustrated in this study.

Materials and Methods

In this experimental study, acanthocephalan samples were obtained from 272 collected

rats, *Rattus rattus* and *Rattus norvegicus* during two occasions of civil pest control programs in Tehran, using poison bait and living traps in two different times from 1991-2010. Careful dissection was performed for each rat and worms were precisely removed from their infected small intestines in the laboratory of Parasitology, School of Public Health, Tehran university of Medical Sciences, Iran. Parasite identification was carried out after immersing the specimens into lactophenol solution to give them enough transparency. Specification confirmed by comparing with species, which have been already described in reliable key references (7, 8). For a deeper understanding of histopathological changes in infected intestines, tissue sections were underwent fixation, dehydration, paraffin blocking, tissue sectioning and finally hematoxylin and eosin (H&E), staining.

Ethical issues were approved by Ethics Committee of the School of Public Health, TUMS.

Results

Samples Information

Acanthocephalan infections were seen in 9 Individuals out of 272 (3.30%) collected rats during two decades in Tehran the capital city of Iran. The prevalence of the rat species which has been trapped in two periods is indicated of 43(25.29%) and 127(74.70%) in the first decade for *R. rattus* and *R. norvegicus* and 82 (80.39%) and 20(19.60%) in the second decade for the two species respectively (Table 1). The rat collection has not undergone a regular timetable but the occurrence rate has shown a similar result. Worm burden was also in the same condition among the rodents with two exceptions of recently collected rats from which 141 and 73 acanthocephals were revealed (Fig.1).

According to the reliable reference keys, the worms were eventually identified as *M. moniliformis* (8).

Histopathological findings

Pre dissection appearance of the rat with 141-worm burden was abnormal belly large. Aggregation of the worms in the lumen of the small intestine has been transparently visible from the serosal membrane.

During the dissection intestinal wall were seen thinner than usual. Macroscopically, the small intestine was distended and its lumen occupied by large number of the acanthocephalan parasites. Microscopically, due to the pressure exerted by the parasites, the gut mucosa showed atrophic changes characterized by shortening and blunting of the villi, a significant decrease in the cryptal depth and mucosal thickness and an increase in the goblet cell population (Fig.2 and 3). Furthermore, an increase in the lymphoid cell number and an infiltration of eosinophilic leukocyte were seen in lamina propria (Fig .4).

In the intestinal lumen, there were presence of accumulated mucosal secretions, attached epithelial cells, and cell debris, and the cross sections of acanthocephalan worms. In the cross sections of the parasites, well-defined integument, a thick tunica muscularis, and the worm internal organs, including digestive and reproductive tracts harboring eggs (Fig. 5) were noticed. The presence of the parasites within intestinal lumen was accompanied by significant mucosal alterations, which in turn resulted in the malfunctioning of the gut mucosa.

Microanatomy of Acanthocephalan, M. moniliformis in transversal sections

To some extent, Acanthocephalans are similar in transversal section morphology to nematodes, including body cavity as all pseudocoelomates demonstrate. Wrinkled appearance of the worms in longitudinal and/or transversal tissue sections may bring pre-

liminary confusion in distinguishing them from cestodes by amateurs. Armed retractable proboscis is the most illustrious characters of acanthocephala “thorny headed worms” to be identified with no trouble even by parasitologist those with less experience. According to Chitwood description (9) following morphological structures are considered as reliable tools for definite identification of acanthocephalan as well as *M. moniliformis* in tissue sections. In Fig. 6, thin cuticle (a), thick hypodermis including the felted layer (b), cross fibers (c), lacuna(d), longitudinal muscles (e), circular muscles (f) and ova (g) are predominant representative for acanthocephalan recognition in cross sections.



Fig.1: 141 worms revealed from the intestine of one of the most infected rats



Fig. 2: The cross section of Acanthocephalan parasite within the intestinal lumen. Alteration of mucosal surface, presence of mucosal secretion, cell debris and detached epithelial cell are seen. H&E (Bar=500µm)

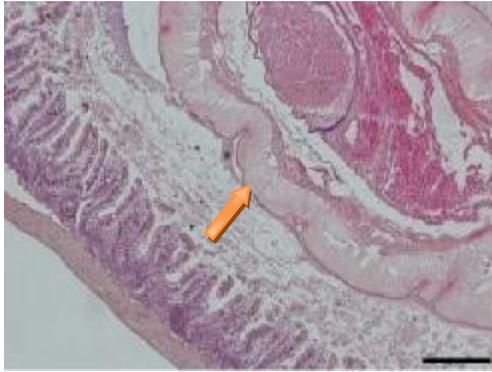


Fig. 3: A higher magnification of Fig. 2 showing Integument head arrow (Bar=500µm)



Fig. 5: A closer view of the parasite ova within reproductive tract. H&E (Bar=100µm)

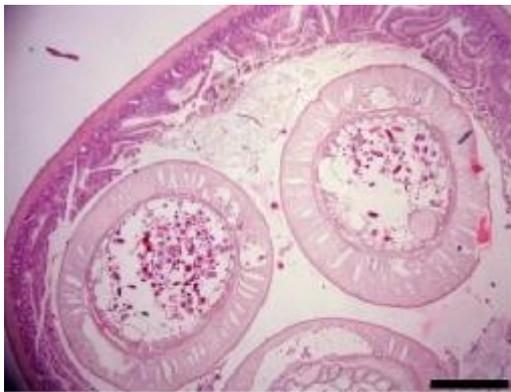


Fig. 4: Three cross sections of Acanthocephalans parasites within intestinal lumen, mucosal changes and large number of ova within reproduction tract of the parasite are noticed, H&E (Bar=1000µm)

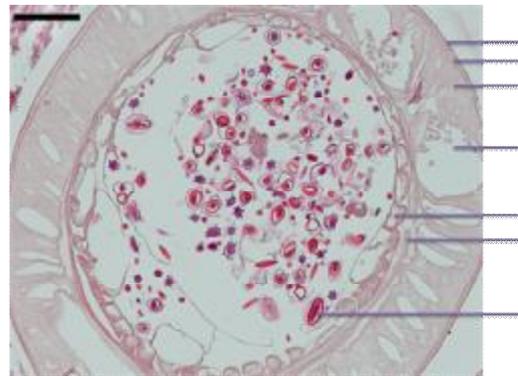


Fig. 6: A higher magnification of female parasite cross section stained with H&E (Bar=500µm) Thin cuticle (a), thick hypodermis including the felted layer (b), cross fibers (c), lacuna (d), longitudinal muscles (e), circular muscles (f) and ova (g)

Table 1: The infection rate of *M. moniliformis* in two popular rat species

Time of Collection	Rat Species		Infection rate	
	<i>R. rattus</i>	<i>R. norvegicus</i>	<i>R. rattus</i>	<i>R. norvegicus</i>
	No. (%)		No. (%)	
1991 – 2001	43 (25.29)	127(74.70)	3(6.97)	1(0.7)
2002 – 2010	82 (80.39)	20(19.60)	5(6.09)	0(0)
Total	125(45.95)	147(50.04)	8(6.4)	1(0.68)

Discussion

The biology of *M. moniliformis* clearly explains the reasons of scarcity of this helmin-

thic infection among the average population of humans worldwide. Those minorities and

tribes with any extraordinary folkloric practices should be ignored herein (10). Therefore, accidental ingestion of infected arthropods can be considered as the main route of infection within humankind. Although the overall frequency of human acanthocephaliasis is globally low and the most human infection reports have shown to be lightened, however, in the case of heavy infections the invasive tendency of the worms to perforate host intestinal wall seems to be life threatening (3).

During the current sampling which has been occasionally carried out within a civil rat control program, the most two heaviest infected rats by 141 & 73 *M. moniliformis* were observed respectively. To the best knowledge of the authors, these levels of worm burden in rodents have never been recorded before in the country. Abundance of black and brown rats as susceptible definitive hosts along with the prevalent cockroaches such as *P. americana* as biological vectors (11) drags the mind of researchers toward the importance of chance of human infection in our surroundings. The transmission patterns, which are regarded for these thorny headed worms, place the young children at the highest level of risk acquisition as they habitually ingest uncertain objects while crawling. Almost the entire number of human case reports since three decades ago until the latest one in 2008, in Iran, has shown the occurrence amongst children (4, 12). Conclusively, following basics of hygiene and environmental health guidelines are essential measures to prevent infection transmission in human populations. Regular civil pest control programs for rats and cockroaches along with food department sanitation, specifically within populated areas are of the great importance toward prevention of arthropod transmitted helminthes.

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