



Research Article

Pathological Changes Caused by Nematode Parasites in the Intestine of Domestic Pigeon (*Columba livia*) of Karachi, Sindh, Pakistan

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Abstract | Pigeons are the warm-blooded vertebrates that belong to Class Aves. They are used for many purposes like for rearing and food are the important aspects. They become parasitized by many of the parasites through their feeding and feeding habitat or by some infected birds that live in association with them. The majority of the nematode parasites that inhabit the body of the pigeon reside in the intestine. Nematodes are the worms that inhabit the intestines either by making coils in the tunnels of the intestine or by attaching themselves to the mucosal layers. This causes severe pathogenicity in the intestine as a result the pigeon shows signs and symptoms of illness. Pathological studies of tissues from infected intestine reveal several changes from the normal architectural organization of tissues. The most common findings were massive congestion, cellular infiltration, atrophy, hypertrophy and dystrophy of cells and disintegration of cellular layers, fibrosis, necrosis and dilation and proliferation of blood vessels.

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Introduction

Pigeons of order Columbiformes are one of the animals that are domesticated over millions of years. People use them as a source of food and for breeding purposes too. Pigeons act as hosts for many ecto and endoparasites. These parasites live in and on the body of the pigeon and in turn, make them emaciated by giving different mechanical damages to their bodies.

Very little work has been done on *Columba livia* in Karachi concerning the effect of nematode parasites

and their pathological changes caused by them in the intestine. Nematode parasites reside in the intestine of pigeon that enters the body by any means. The nematodes that are usually identified from the intestine of pigeons are *Ascaridia* sp. and *Capillaria* sp. Both have profound effects on the health status of pigeons.

The a present study aimed to locate a variety of nematode parasites and the pathogenicity caused by them in the pigeon. Because the pigeon breeders are at risk of acquiring infection from the infected pigeon. So this study may also create awareness regarding

nematode infection, their mode of transmission and what should be the preventive measures that a rarer must adopt to keep the pigeons out of infection.

Materials and Methods

About 10 specimens of *Columba livia* were brought to the laboratory of Parasitology, at the University of Karachi collected from different localities, for examining internal parasitic infection and histopathological changes caused in response to nematode infection. Post mortem examination was carried out and nematode parasites were collected from the intestine and preserved in a mixture of 70% ethyl alcohol and glycerin. The affected intestine was then preserved in 5% formalin which is a successful fixative for histological sections. Fixed material was passed from graded series of alcohol for dehydration of tissues and after dehydration, a mixture of paraffin wax and xylene was made in a vial and dehydrated tissue will be kept and heated gently for 5-10 minutes and left for 24 hours. After that, the mixture was discarded and pure wax is put into the same vial and again heated for 3-4 minutes and then the block was made in L-block. 6 to 8 micron thick sections were prepared by rotatory microtome and were kept on the slides which already had a little egg albumin on their surface to avoid dropping off sections during deparaffinization. Sections were stretched with a slight heat and then stained with hematoxylin and eosin by standard method and mounted permanently in DPX. Photography of histological slides was done by Nikon (Optiphot- II).

Results and Discussion

Pathological variations were observed in the intestine of domestic pigeon *Columba livia* infected with nematode parasites. Microscopic examination revealed severe cellular changes, massive degeneration and infiltration of inflammatory cells (Figure 1). Blood vessels appeared thick with fibrosis (Figure 1). Atrophy and fibrosis of mucosal and sub-mucosal layers of the intestine were obvious (Figure 2, 3). Hypertrophy of villous crypts was noticed whereas villi were completely washed out (Figure 3). Nematode larvae were also observed in the sections (Figure 3). In some sections, complete dystrophy was noticed revealing aggregation of eosinophils among necrotic tissues (Figure 4). Migratory tunnels were found due to nematodes in muscularis mucosa and sub-mucosa (Figure 5)

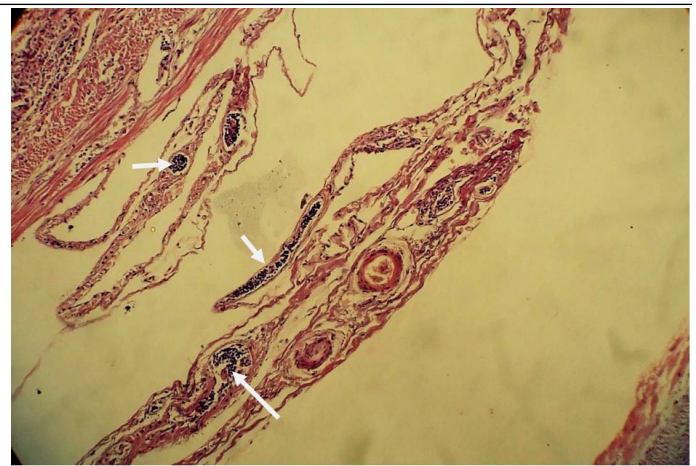


Figure 1: High magnification shows massive degenerative changes and infiltration of inflammatory cells (Arrows). Blood vessels appeared with a thick fibrotic wall. Migratory tunnels and penetration sites of parasites are also obvious. $\times 200$.

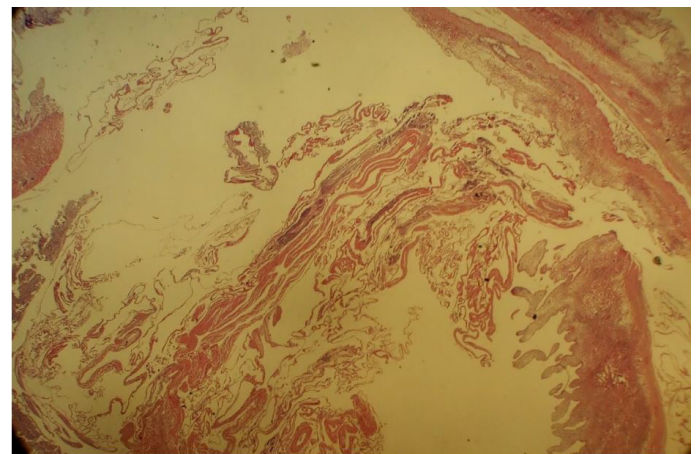


Figure 2: Section of intestine infected with nematode (*Ascaridia* sp. and *Capillaria* sp.) shows atrophy and fibrosis of mucosa and sub-mucosa. $\times 40$.

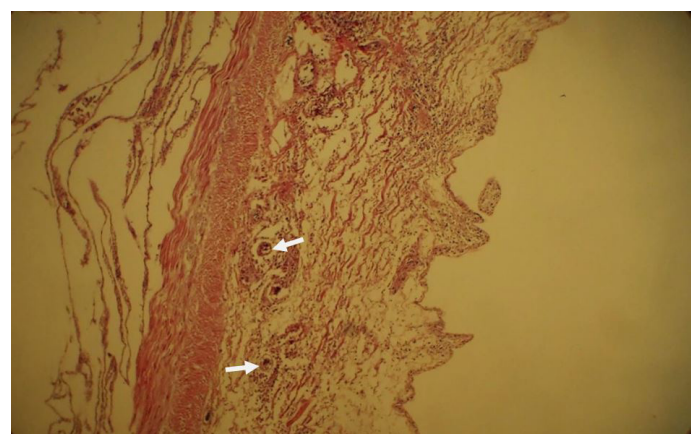


Figure 3: A section of the intestine infected with nematodes shows the complete destruction of all cellular layers. Hypertrophy of villous crypt is observed whereas villi are completely washed out. Fibrosis of mucosa and sub-mucosa is also obvious. Section of nematode larvae (*Ascaridia* sp.) observed in this section. (Arrow) $\times 100$.

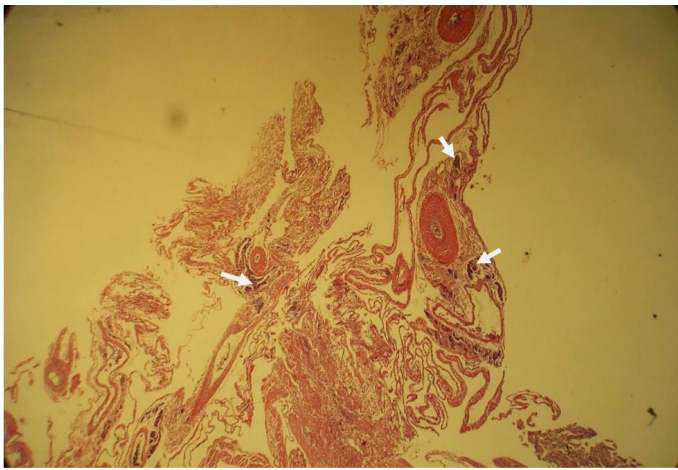


Figure 4: Photomicrograph of the intestine section infected with nematodes (*Ascaridia* sp. and *Capillaria* sp.) shows total dystrophy of tissues. Aggregation of eosinophils (arrow) is obvious among necrotic tissue. × 40.

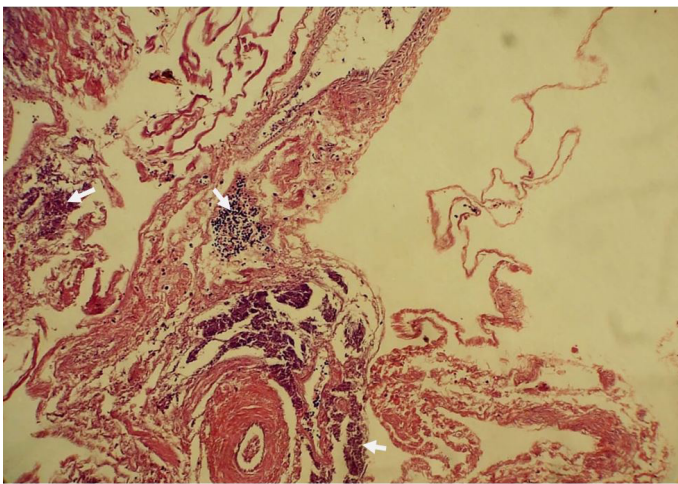


Figure 5: A portion of the intestine shows migratory tunnels formed due to nematodes (*Ascaridia* sp.) in muscularis mucosa and sub-mucosa. Aggregation of eosinophils found at the infestation site of parasites (arrow). Infiltration of inflammatory cells is also obvious throughout the area. × 200.

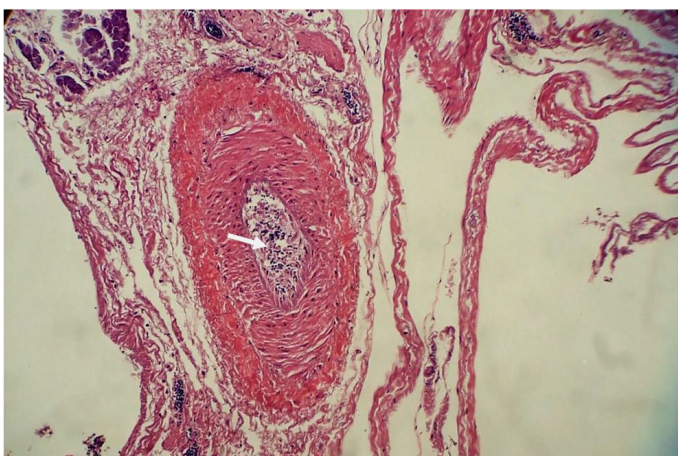


Figure 6: High magnification shows proliferated blood vessels with inflammatory cells. (Arrow). × 400

along with aggregation of eosinophils found at the infestation site of parasites. Dilated blood vessels due to parasitic infection were also found during the period of study (Figure 6).

Fibrotic infiltration disintegrated cellular organization of infected intestine and eosinophils scattered throughout the section were identified (Figure 7). Section of nematode larvae was also obvious surrounded by necrotic tissues (Figure 8).

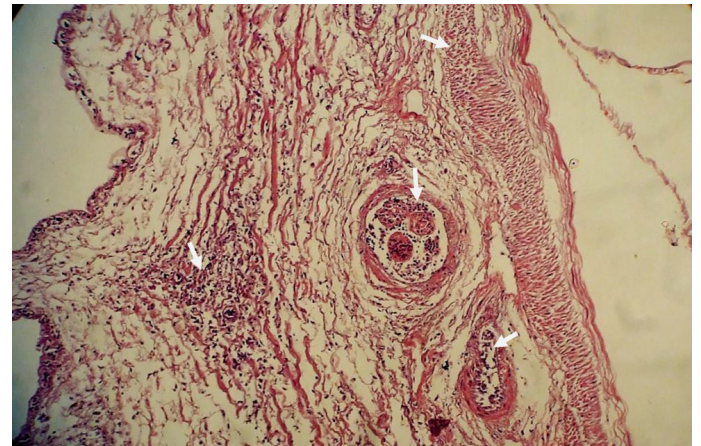


Figure 7: The micrograph of the intestine shows the orientation of cellular organization disintegrated by fibrotic infiltration. Eosinophils are scattered throughout the section due to heavy infection of cestodes and nematodes (*Ascaridia* sp. and *Capillaria* sp.) (Arrow) × 200.

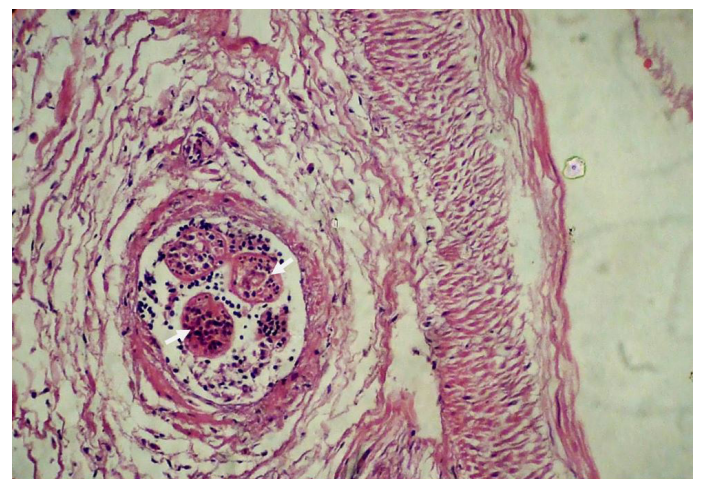


Figure 8: High magnification shows degeneration of all layers. Villi are also completely washed out. Section of nematode larvae (*Ascaridia* sp.) surrounded by necrotic tissues. (Arrow) × 400.

Columba livia is one of the avian animals that is domesticated in every part of the world. Histopathology in the gastrointestinal tract in pigeons is mostly associated with worm burden mostly of cestodes and nematodes. Heavy infestation results in

severe damage in different organs where the lodging has been occurred by parasites. [Anwer et al. \(2000\)](#) described the architectural changes in the intestinal layers due to infection caused by *Raillietina tetragona* which was somewhat similar to our findings. Upon histology fibrosis and architectural degeneration of lamina propria were observed while [Shaheen et al. \(2005\)](#) discussed cellular and histological variations from that of normal morphology. The organs which were parasitized include the lungs, spleen and liver and were histologically studied for changes. [Basit et al. \(2006\)](#) studied blood parameters of infected pigeons in which they found variations in the morphology of blood cells resulting due to infection as we have also noticed the scattering of eosinophils in the tissues as a result of heavy helminthic infection.

Results of histopathological examination revealed by [Adang et al. \(2010\)](#) also described several changes as compared to normal ones as the result of *Ascaridia galli* infestation. The tissues which were mainly observed include lungs, kidneys, heart and intestine. Their observations resemble that our results of pathological studies which mark atrophy and fibrosis of mucosal and sub-mucosal layers of the intestine caused in response to cestode and nematode infection. Degenerative changes in the intestinal layers were also observed by [Bahrami et al. \(2013\)](#) which were similar to that is marked in our observations caused by nematode infection.

[Abed et al. \(2014\)](#) explained disintegration, ulcerations, degeneration of villi and several inflammatory responses that were also common in our findings. [Shaikh et al. \(2016\)](#) indicate cellular infiltration and aggregation of lymphocytes, migratory tunnels at the site of parasite attachment, fibrosis of mucosa and sub-mucosa and atrophied tissues. All these changes are also obvious in our findings that reveal that pigeons are severely damaged internally from a histological perspective in response to helminthic infection. [Moudgil et al. \(2017\)](#) also showed hyperplasia and cellular morphological and histological changes as we have shown in our images of histopathology.

It was concluded from all of the above mentioned observations collected upon histological studies that severe damage results in the intestine of pigeons due to parasitic infestation which leads to generalized weakness, lack of motility, sluggish behaviour,

fecundity or less egg production, suppression in reproductive activities and many more.

Novelty Statement

This work would be an addition with reference to histopathological changes in pigeon's intestine of Karachi as very few studies have been conducted regarding this aspect from Pakistan.

Author's Contribution

Rizwana Abdul Ghaffar: Prepared histopathological slides and studied pathological slides.

Kamil Nadeem: Studied and processing pigeon for the collection of parasite and infected tissues.

Conflict of interest

The authors have declared no conflict of interest.

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