SHORT COMMUNICATION

Baruscapillaria obsignata: a serious cause of enteropathy and high mortality in turkeys (meleagris gallopavo)

Munuswamy Palanivelu, Mariappan Asok Kumar, Shambhu Dayal Singh, Annamalai Latchumikanthan, Sharanabasav Badami, Gautham Kolluri, Rajendra Singh, Kuldeep Dhama and Raj Kumar Singh

Avian Diseases Section, Division of Pathology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, India; Division of Parasitology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, India; Division of Biochemistry, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, India; Division of Avian Physiology and Reproduction, ICAR-Central Avian Research Institute, Izatnagar, Bareilly, India; Director, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, India

ABSTRACT

Background: Capillariasis, an important parasitic disease of birds is caused at least by seven different genera of trichurid nematodes with clinical outcome ranging from mild enteritis to high mortality.

Objective: This study was aimed to investigate the causative agent involved in high mortality associated with severe enteric illness among turkey flocks in an organized commercial poultry farm at Bareilly, India.

Materials and Methods: Turkey carcasses (n = 119) and fecal samples from the affected deep litter pen constituted as the study materials. The disease was investigated by systematic necropsy, direct microscopy and histopathology. Representative samples were screened for other enteric pathogens.

Results: Microscopic examination of mucosal scraping revealed capillarid worms and their eggs in all the samples. The morphological features of adult worms were typically consistent to Baruscapillaria obsignata. Histopathology exhibited thickened muscular and mucosal layers, mononuclear and heterophilic infiltration in the lamina propria, blunting and clubbing of villi, epithelial denudation and sections of capillarid worms. Administration of levamisole at 80 ppm in drinking water reduced the mortality, clinical illness and worm load after three days of therapy.

Conclusions: The capillarid worms in different avian hosts can cause different clinical manifestations and outcomes. From India, this is the first report describing intestinal pathology caused by B. obsignata in turkeys. We conclude that the B. obsignata infection is capable of causing life threatening enteropathy in turkeys and, hence, routine screening, scheduled deworming and good litter management are crucial to control the infection and its associated loss.

1. Introduction

Capillariasis is a helminthic infection caused by a large group of trichurid nematodes with approximately 300 species which are widely distributed and parasitize all vertebrates (Moravec et al. 1987; Yabsley 2008; Barathidasan et al. 2014). The avian capillarid worms belong to different genera that include Baruscapillaria, Capillaria, Echinocoleus, Eucoloeus, Ornithocapillaria, Pterothominx and Tridentocapillaria. These tiny nematodes, commonly known as ‘hair worms’, are placed in the superfamily Trichinelloidea, family Capillaridae and subfamily Capillarinae. The eggs of Baruscapillaria obsignata are shed in feces and larva develops inside egg in 6–8 days. When these infective eggs are ingested by birds, 4–5 moltings occur in the intestine and adult worms develop in 19–22 days depending upon the species of birds affected (Moravec et al. 1987). In domestic poultry, these worms parasitize different segments of the gastrointestinal tract and cause severe enteric illness and associated mortality. At least six well-recognized species of capillarid worms are reported to infest the gastrointestinal tract of poultry which include Eucoloeus annulatus, Aonchotheca bursata, Eucoloeus contorta, Aonchotheca caudinflata, B. obsignata and Capillaria anatis. Any of these six species can cause mild enteritis to life threatening enteric disease in domestic fowls including turkeys. Severe gastro-enteritis and mortality have been reported due to capillarid worm infections especially in Galliformes (Rickard & Pohl 1969; Barus & Sergejeva 1989; De Rosa & Shivaprasad 1999; Singh 2010). There are few reports traced on enteric Capillariasis caused by B. obsignata infections in chickens (Jortner et al. 1967), turkeys (Hurst et al. 1979; De Rosa & Shivaprasad 1999; Pinto et al. 2008) and rock partridges (Park & Shin 2010) globally. In India, capillarid eggs have been detected in...
feces of few turkeys (Singh et al. 2006; Das et al. 2015). However, the intestinal pathology caused by *B. obsignata* in turkeys has not been documented earlier in India. This is the first report that describes the enteric pathology caused by *B. obsignata* in turkeys, and evaluates the morphologic and morphometric features of adult worms and their eggs.

### 2. Materials and methods

We investigated turkey flocks maintained in an organized commercial poultry farm comprising 380 turkeys to elucidate the cause of high mortality estimated at three weeks duration. A total of 119 turkey carcasses aged between 18 and 52 weeks were submitted for disease investigation in a span of three weeks during February 2015. The affected turkey flock was investigated by systematic necropsy, direct microscopy and histopathological examination based on random sampling out of 119 birds. The submitted carcasses were subjected to detailed necropsy and gross pathological lesions recorded individually. The segments of intestine with pathologically significant lesions were collected and transported to the laboratory within 20 minutes after necropsy. Loop of unopened intestine was submitted for isolation and identification of pathogenic bacteria, specifically *Clostridium perfringens*. The intestinal segments with grossly visible lesions were opened and photographed. Representative tissue samples from small intestine with lesions were collected in 10% neutral buffered formalin for histopathology. The mucoid content from the lumen was placed on a clean microscopic slide and mixed with few drops of water. Then, the diluted content was gently spread with the help of a blunt forceps and examined by naked eye against bright light source to detect any tiny worms. Then, the contents from intestinal and cecal lumen were collected in small eppendorf tubes to examine for eggs, oocysts and parasitic load by direct microscopy. The morphological features and morphometry of male and female worms and eggs were assessed to identify the species of parasite as described earlier (Moravec 1982; Moravec et al. 1987; Permin & Hansen 1998; Yabsley 2008; Park & Shin 2010; D’Ávila et al. 2011; Barathidasan et al. 2014). The formalin fixed tissues were processed for paraffin embedding and the obtained tissue sections were stained with Hematoxylin and Eosin (H&E) to study the histopathological alterations.

### 3. Results

The mortality during the investigation period was 31% with daily case fatality ranging between 3 and 13 birds out of 380. Treatment of the affected turkey flock with levamisole at 80 ppm in drinking water for three days reduced the mortality in the affected turkey flocks.

#### 3.1. Gross and microscopic findings

Gross necropsy findings indicated debilitated turkey carcasses with soiling of vent and hind quarters, abnormally thickened intestine, segmental saccular dilations and congested mesenteric blood vessels (Figure 1). The intestinal lumen contained excessive catarrhal exudate and strings of clotted blood. The duodenal mucosa revealed presence of petechial to ecchymotic hemorrhages in all the affected birds (Figure 2). Careful examination of luminal contents for parasites exhibited presence of numerous tiny hair-like structures which were confirmed as capillarid worms by direct microscopy. The worm load and intensity of intestinal lesions between the single birds were different, but we did not quantify the worm burden and the intensity of lesions. Mucosal scrapings and collected worms when observed under microscope revealed the presence of numerous thin adult worms and barrel-shaped eggs with prominent bipolar plugs consistent with morphology of *Baruscapillaria* species (Figure 3). The worms were seen with a stichosome glandular...
esophagus consisting of variable number of stichocytes at their anterior part of capillarid nematodes. The posterior end of male had pseudobursa with a single, long non-spiny spicular sheath and two ventrolateral projections without caudal alae (Figure 4). The female worms showed vulva region at middle of the body and the eggs were having prominent bipolar plugs (Figure 5).

Based on these morphological features and location of lesions/predilection site in the host, the parasite was identified as *B. obsignata*. The micromorphometric details are given in Table 1.

### 3.2. Histopathological studies

Histopathologically, the epithelial cells lining the intestinal mucosa were necrosed at places and denuded into the lumen. The intestinal villi showed blunting and clubbing, vascular congestion and expansion of lamina propria with mononuclear cellular infiltrates predominated by the lymphocytes, histiocytes and few plasma cells (Figures 6 and 7). However, infiltration of heterophils was consistent in most of the cases. The lumen contained sections of numerous capillarid worms in the mucous (Figure 8). The mucosal layer was remarkably thickened with increased goblet cell activity, and the crypts of Lieberkuhn at places showed mild to moderate degree of degenerative changes amidst few mononuclear cellular infiltrates and heterophils. The tunica muscularis layer of jejunum was markedly thickened in all the cases.

### 3.3. Differential diagnosis

Attempts were made for detecting possible viral and protozoan pathogens such as Avian adenovirus...
infection and coccidiosis, but the cases were found negative. Bacterial culture from the intestinal contents did not yield pathogenic bacteria such as toxigenic *C. perfringens* which is reported to be one of the common causes of enteritis. Based on this investigation, the high mortality in the affected turkey flocks was attributed to enteropathy caused by *B. obsignata* infection.

4. Discussion

Enteric Capillariasis caused by *B. obsignata* is known to occur in all birds belonging to Anseriformes, Ciconiiformes, Columbiformes, Galliformes, Piciformes and Psittaciformes (Jortner et al. 1967; Rickard & Pohl 1969; Pinto et al. 2004; Pinto et al. 2008; Yabsley 2008; Park & Shin 2010; D’Avila et al. 2011). There are few reports traced on enteric Capillariasis caused by *B. obsignata* infections in turkeys, and the severity of the disease was different in each report (Hurst et al. 1979; De Rosa & Shivaprasad 1999; Pinto et al. 2008). In India, Singh et al. (2006) and Das et al. (2015) have detected capillarid eggs in feces of few turkey birds. However, the enteric pathology caused by *B. obsignata* in turkeys and the morphological features and morphometric parameters of the parasite has not been documented earlier. We, in the present study, report the gross and histomorphological alterations of intestine in *B. obsignata* infection in farmed turkeys. This is the first report from India that describes the intestinal pathology, morphology and morphometry of *B. obsignata* in detail. This is important because the severity of tissue damage and functional derangement caused by the parasites can only determine the pathogenic potential of parasite. Jortner et al. (1967) reported that worm load of above 30 in the intestine, can cause epithelial desquamation, blunting and shortening of villi and inflammation of lamina propria in chickens. Later, Pinto et al. (2008) and Barathidasan et al. (2014) have observed blunting and clubbing of villi, infiltration of lamina propria with mononuclear cells and heterophils, and abnormally thickened muscular layer in *Capillaria* infected turkeys and guinea fowls, respectively. The gross and histomorphological tissue alterations in the present study were consistent with earlier reports. However, the intensity and degree of tissue damage was much higher than the earlier reports. Although we did not quantify the worm load and intensity of enteric pathology, our observation showed that the number of worms per three drops of intestinal contents was more in those cases which displayed severe gross lesions such as extensive catarrhal exudates, ecchymotic hemorrhages and saccular dilatations in comparison with cases that had mild enteric pathology. The mucosal damage caused by the worms interferes with digestion and absorption of nutrients resulting in decreased appetite, diarrhea, debility, and subsequently, death of the affected birds. Capillarid worms are reported to cause lower growth rates, decreased production and reduced fertility in birds (Rickard & Pohl 1969). The intestinal thickening in Capillariasis has been attributed to chronic and repeated infection, high worm load and frequent diarrhea (Wakelin 1965; Moravec et al. 1987). Since the fecal content from litter materials invariably contained adult worms and eggs, continuous contamination of litter by infected birds might have facilitated the rapid spread of infection and clinical form of disease in the current outbreak. The capillarid infections can be treated with common anthelmintic drugs, but fenbendazole, febantel and levamisole are considered highly efficacious in avian species (Yabsley 2008). In this outbreak, the infected turkey flock was treated with levamisole at 80 ppm in drinking water for three days which considerably reduced the worm load and controlled the mortality. Since this parasite takes about 19–22 days to mature from infective eggs to adult worms, two cycles of anthelmintic treatment at 20 days interval were advised to control the infectivity in other susceptible flocks.
5. Conclusion

Enteric parasitism is one of the common problems in poultry, but it is often neglected until and unless the affected farm experiences severe production loss and mortality. We, in the present investigation, relate the high mortality in the investigated turkey flock to severe enteritis caused by *B. obsignata* infection. As there are limited reports available on capillarid infection in turkeys, the present report on *B. obsignata* infection associated with enteropathy and high mortality in turkeys adds additional information on intestinal pathology, morphometric parameters and diagnostic features of *B. obsignata* infection to the existing information. It is clearly evident from the earlier reports and our investigation that intestinal Capillariasis in avian species can be a serious concern if the birds are infected. Therefore, we emphasize on routine screening, timely diagnosis and treatment, regular deworming and good litter management practices crucial to reduce the infectivity and control the disease in susceptible hosts.

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Disclosure statement

The authors declare that they have no competing interests.

ORCID

Munuswamy Palanivelu http://orcid.org/0000-0002-1221-5231

Kuldeep Dhama http://orcid.org/0000-0001-7469-4752

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