

# Toxocariosis in a Nigerian Indigenous Puppy – An Investigation of the Pathological Findings and Possible Associated Systemic Complications

Ochuko Orakpoghenor<sup>1,3\*</sup>, Garleya Bilbonga<sup>2,4</sup>, Faruk Saidu Usman<sup>2</sup>, Maryam Suleiman Ibrahim<sup>2</sup>, Hassan Muhammad<sup>2</sup> and Sunday Blessing Oladele<sup>2</sup>

<sup>1</sup>Diagnostic Pathology, Faculty of Pathology, Zaria Study Centre, College of Veterinary Surgeon Nigeria

<sup>2</sup>Department of Veterinary Pathology, Faculty of Veterinary Medicine, Ahmadu Bello University Zaria, Nigeria

<sup>3</sup>Department of Veterinary Pathology, Faculty of Veterinary Medicine, Bayero University Kano, Nigeria

<sup>4</sup>Department of Animal Production and Health, Federal University Wukari, Nigeria

\*Corresponding author: Ochuko Orakpoghenor; ochuko.orakpoghenor@gmail.com; +2347067522037

<https://doi.org/10.21608/svu.2024.331170.1351>

Submit Date: 2024-10-25 Revise Date: 2024-11-04 08 Accept Date: 2024-11-05

**Copyright:** © Ochuko Orakpoghenor et al. This is an open access article distributed under the terms of the creative common attribution license, which permits unrestricted use, distribution and reproduction in any medium provided the original author and source are created.



## ABSTRACT

The carcass of a three-month-old Nigerian indigenous puppy (3 kg), with no vaccination history, was presented to the Necropsy Unit of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria. Prior to death, the clinical observations were worms in vomitus and bloody diarrhoea, and the medications administered were gentamicin injection and praziquantel tablet. On postmortem examination, the findings were severe emaciation, rough hair coat, adhesion of the skin to the muscles, markedly sunken eyeballs, pale ocular mucous membranes, ballooning, presence of worms (*Toxocara canis*) in the lumen, and extensive serosal and mucosal haemorrhages of the intestine, thickened intestinal mucosa with nodular growths, mottled enlarged and congested liver, cardiomegaly with serous atrophy of pericardial fat and endocardial petechial haemorrhage, and adhesion of renal capsule. In conclusion, the necropsy findings revealed severe toxocariosis, marked intestinal haemorrhages, and multi-organ involvement, consistent with severe systemic parasitism and malnutrition. Hence there is need for regular deworming and timely vaccination in puppies to prevent severe parasitic infections and associated systemic complications.

**Keywords:** toxocariosis, *Toxocara canis*, necropsy, malnutrition

## INTRODUCTION

Toxocariosis is a parasitic disease caused by *Toxocara canis*, a common intestinal roundworm in dogs, especially puppies. The parasite is primarily transmitted through the ingestion of infective eggs from contaminated environments hence, poor sanitation and lack of regular deworming constitute the major

predisposing factors (Adeppa & Gnani Charitha, 2024; Dixit et al., 2024). Toxocariosis is of significant concern in veterinary practice due to its potential to cause severe systemic illness in young animals. Puppies are more susceptible to the disease due to their immature immune systems, thus, are at higher risk of developing clinical signs which range from gastrointestinal

disturbances to multi-organ complications (García-Rubio et al., 2023; Grellet & Mila, 2024). In infected puppies, the common signs include vomiting, diarrhoea, and emaciation, as well as systemic signs such as anaemia, respiratory distress, and neurological involvement in more severe cases (Raza et al., 2018; Docu Axelerad et al., 2021).

In Nigeria, toxocariosis in indigenous dog breeds is a growing concern due to limited access to regular veterinary care, including vaccination and deworming (Gado et al., 2023). The condition can lead to significant morbidity and mortality in these puppies, especially in regions where veterinary services are either unavailable or underutilized (Schwartz et al., 2022). The treatment of toxocariosis in dogs primarily involves the administration of anthelmintics such as praziquantel, while vaccination protocols focus on the prevention of co-infections that may exacerbate the effects of the parasite effects. Hence, regular deworming and environmental sanitation are

crucial in managing infection and preventing re-infestation (Raza et al., 2018; Henke et al., 2023).

This study focused on a three-month-old male Nigerian indigenous puppy presented for necropsy, aimed at investigation of the pathological findings associated with severe toxocariosis and potential systemic complications. An understanding of the pathological features of this condition could inform more effective prevention and treatment strategies, especially in settings with limited resources.

## CASE PRESENTATION

The carcass of a three-month-old Nigerian indigenous puppy (3 kg) was presented to Necropsy Unit of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria. Prior to death, the clinical observations were worms in vomitus and bloody diarrhoea. It was said to have been vomiting 3 days earlier, and the medications administered were

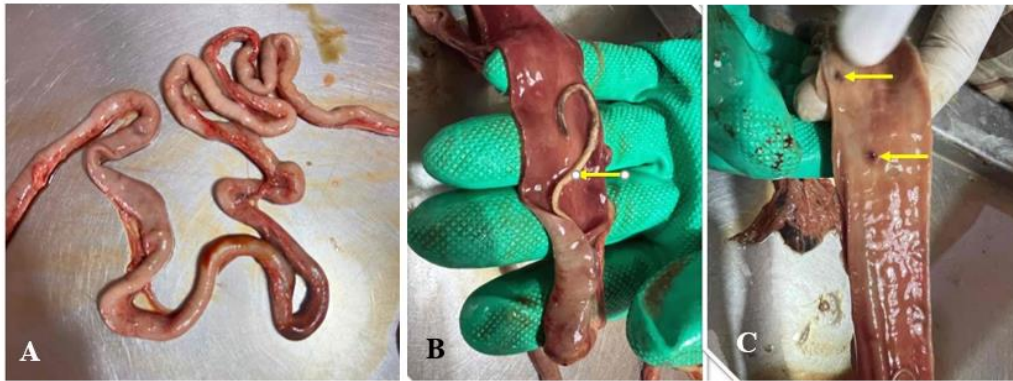


**Fig 1.** Severe emaciation with rough hair coat (A), sunken eye ball (B), prominent ribs and extensive loss of muscle mass (C).

Gentamicin injection for 2 days and praziquantel tablet 2 days prior to presentation. The puppy was fed with pap, and had no vaccination history.

markedly sunken eyeballs (Figures 1A and B), pale ocular mucous membranes.

Pathological findings – severely emaciated carcass with prominent ribs and extensive loss



**Fig 2.** Ballooning of the small intestine (duodenum) and extensive haemorrhages on the serosa (A), presence of worms (arrow) and extensive haemorrhages on the mucosa of the duodenum (B), thickened intestinal mucosa with nodular growths (arrows) (C)

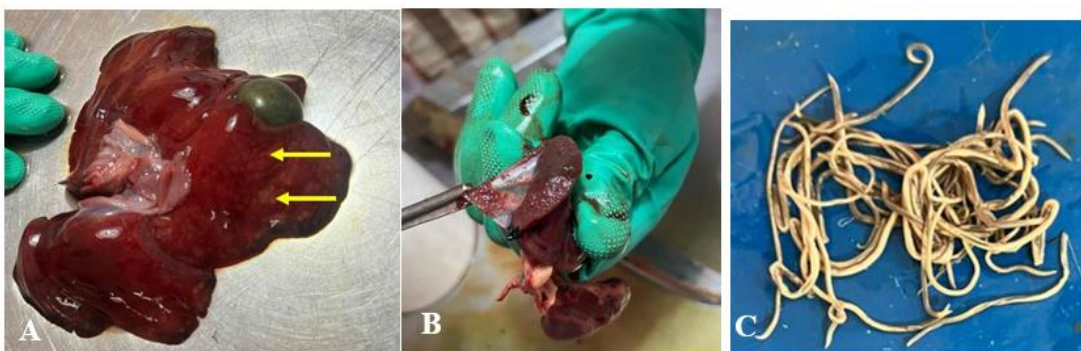
## INVESTIGATION

Postmortem examination was conducted. Also, the worms seen were sent to the helminthology laboratory for identification.

## OUTCOME AND FOLLOW-UP

General examination - poor general body condition, severe emaciation, rough hair coat, adhesion of the skin to the muscles on flaying,

of muscle mass (Figure 1C), ballooning, presence of worms in the lumen, and extensive haemorrhages on the serosa and mucosa of the duodenum, thickened duodenal mucosa with nodular growths, blockage of the duodenal lumen by the worms (Figures 2A-C), mottled, enlarged and congested liver, adhesion of renal capsule (Figures 3A and B), cardiomegaly with



**Fig 3.** Mottled (arrows), enlarged and congested liver (A), adhesion of renal capsule (B) and adult *Toxocara canis* (C).

serous atrophy of pericardial fat and endocardial petechial haemorrhage, and adhesion of renal capsule.

## PARASITE IDENTIFICATION

The worms identified were *Toxocara canis* (Figure 3C). The identification of *T. canis* was based on morphological characteristics observed. The key features included adult worms in the intestinal lumen (duodenum), identified by their distinct size, color, and structure typical of *T. canis*, as documented in parasitology references. The confirmation was consistent with established diagnostic criteria as cited by Schwartz et al. (2022) and García-Rubio et al. (2023).

## DISCUSSION

The necropsy findings in this case of toxocarosis, including severe emaciation, intestinal hemorrhages, and multi-organ involvement, are consistent with previous studies that have documented the pathogenic effects of *Toxocara canis* in puppies (Schwartz et al., 2019; 2022). Similar to the findings of Sieng et al. (2023) in their study on puppies, this case showed marked intestinal pathology characterized by ballooning, hemorrhages, and thickened mucosa with nodular growths. The presence of adult worms in the intestinal lumen aligns with earlier reports that describe the life cycle of the parasite, where adult *T. canis* worms reside in the small intestine, leading to mechanical obstruction and inflammation

(Schnieder et al., 2011; Raza et al., 2018). The severe emaciation and rough hair coat observed in this puppy are also in agreement with a study by Fauziah et al. (2022), which associated chronic parasitic infections with malnutrition and poor body condition.

The intestinal pathology seen in this case could be attributed to the mechanical damage caused by adult worms as well as the inflammatory response to larval migration. The ballooning of the intestines and serosal and mucosal hemorrhages are typical of heavy worm burdens, which induce irritation, pressure necrosis, and localised vascular damage. In addition, thickening of the intestinal mucosa with nodular growths suggests a granulomatous response, a defense mechanism by the immune system of the host against the larval migration. This mechanism has been documented by previous studies who reported that larval migration triggers a significant eosinophilic and granulomatous reaction, contributing to intestinal lesions and systemic eosinophilia in severe cases (Kowalik et al., 2022; Jasim & Hadi, 2021).

The systemic complications observed in this case, including cardiomegaly with serous atrophy of pericardial fat and nephritis, may be related to chronic malnutrition and the widespread inflammatory response induced by migrating larvae. Similar findings were reported by other studies that noted multi-organ



involvement, including cardiac and renal lesions, in puppies suffering from severe toxocariasis (Kuenzli et al., 2016; Jasim & Hadi, 2021). These systemic effects are believed to arise from the ability of the parasite to migrate through various tissues, and causing damage to the heart, liver, and kidneys. The serous atrophy of pericardial fat observed in this puppy suggests a chronic catabolic state, likely due to malnutrition and energy depletion, as noted in earlier studies on parasitic cachexia (Bolivar-Mejia et al., 2014; Olson et al., 2020).

*Toxocara canis* poses a zoonotic risk, with larvae capable of migrating through human tissues, potentially causing visceral or ocular larva migrans, particularly in children. This presence of the parasite in contaminated soil and animals emphasises the need for public health measures to reduce exposure and limit zoonotic transmission (Chen et al., 2018; Xu & Han, 2024).

## ACKNOWLEDGEMENT

Technical staff of the Necropsy Unit of the Veterinary Teaching Hospital, Ahmadu Bello University Zaria, Nigeria.

## CONFLICT OF INTEREST

The authors declare no potential conflict

## REFERENCES

Adeppa J, Gnani Charitha V (2024). Roundworm Infections in Dogs and Cats. In: Rana, T. (ed), Principles and Practices of Canine and Feline Clinical Parasitic Diseases. New

Jersey, USA: John Wiley & Sons, Inc. Pp. 93-100.

Bolivar-Mejia A, Alarcón-Olave C, Calvo-Betancourt LS, Paniz-Mondolfi A, Delgado O, Rodriguez-Morales AJ (2014). Toxocariasis in the Americas: burden and disease control. *Current Tropical Medicine Reports*, 1: 62-68.

Dixit B, Kumar R, Dixit AK, Singh AK (2024). Risk Factors Associated with Parasitic Diseases in Dogs and Cats. In: Rana, T. (ed) Principles and Practices of Canine and Feline Clinical Parasitic Diseases. New Jersey, USA: John Wiley & Sons, Inc. Pp. 19-30.

Docu Axelerad A, Stroe AZ, Gogu AE, Pusztai A, Jianu DC, Daniel D, Docu Axelerad D (2021). Clinical spectrum of symptoms in cerebral Toxocariasis (Review). *Experimental and Therapeutic Medicine*, 21(5): 521.

Fauziah N, Aviani JK, Agrianfanny YN, Fatimah SN (2022). Intestinal Parasitic Infection and Nutritional Status in Children under Five Years Old: A Systematic Review. *Tropical Medicine and Infectious Diseases*, 7(11): 371.

Gado DA, Ehizibolo DO, Meseko CA, Anderson NE, Lurz PW (2023). Review of emerging and re-emerging zoonotic pathogens of dogs in Nigeria: Missing link in one health approach. *Zoonotic Diseases*, 3(2): 134-161.

García-Rubio VG, Ojeda-Carrasco JJ, Aguilar-Marcelino L, Garfias CRB (2023). Toxocariasis. *One Health Triad*, 3: 164-171.

Grellet A, Mila H (2024). Endoparasitic Diseases in Breeding Kennels: A Frequent and Complex Problem Requiring a Holistic Approach. *Animals*, 14(16): 2357.

Henke K, Ntovas S, Xourgia E, Exadaktylos AK, Klukowska-Rötzler J, Ziaka M (2023). Who Let the Dogs Out? Unmasking the Neglected: A Semi-Systematic Review on the Enduring

- Impact of Toxocariasis, a Prevalent Zoonotic Infection. *International Journal of Environmental Research and Public Health*, 20(21): 6972.
- Jasim SY, Hadi AM (2021). A review study for Toxocariasis. *GSC Biological and Pharmaceutical Sciences*, 16(3): 191-199.
- Kowalik M, Gotos A, Góra-Tybor J (2022). Eosinophilia caused by *Toxocara canis* infection. *Hematology in Clinical Practice*, 13(2): 62-68.
- Kuenzli E, Neumayr A, Chaney M, Blum J (2016). Toxocariasis-associated cardiac diseases--A systematic review of the literature. *Acta Tropica*, 154: 107-120.
- Olson B, Marks DL, Grossberg AJ (2020). Diverging metabolic programmes and behaviours during states of starvation, protein malnutrition, and cachexia. *Journal of Cachexia Sarcopenia and Muscle*, 11(6): 1429-1446.
- Raza A, Rand J, Qamar AG, Jabbar A, Kopp S (2018). Gastrointestinal Parasites in Shelter Dogs: Occurrence, Pathology, Treatment and Risk to Shelter Workers. *Animals (Basel)*, 8(7): 108.
- Schnieder T, Laabs EM, Welz C (2011). Larval development of *Toxocara canis* in dogs. *Veterinary Parasitology*, 175(3-4): 193-206.
- Schwartz R, Bidaisee S, Macpherson CN (2019). *Toxocara canis* in puppies and their public health importance in Grenada. *Caribbean Medical Journal*, 81(1). <https://doi.org/10.48107/CMJ.2019.04.006>
- Schwartz R, Bidaisee S, Fields PJ, Macpherson ML, Macpherson CN (2022). The epidemiology and control of *Toxocara canis* in puppies. *Parasite Epidemiology and Control*, 16: e00232.
- Sieng S, Chen P, Wang N, Xu JY, Han Q (2023). *Toxocara canis*-induced changes in host intestinal microbial communities. *Parasites Vectors*, 16: 462.
- Xu J, Han Q (2024). Prevalence, Infection, and Risk to Human Beings of *Toxocara canis* in Domestic Food-Producing Animals. *Veterinary Sciences*, 11(2):83.
- Chen J, Liu Q, Liu GH, Hong SJ, Sugiyama H, Zhu XQ, Elsheikha HM (2018). Toxocariasis: a silent threat with a progressive public health impact. *Infectious Diseases of Poverty*, 7: 59.

