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Toxocarosis: A very public zoonosis

Toxocara spp are a group of intestinal nematodes with species infecting dogs (*T.canis*) and cats (*T.cati*). They are the cause of human toxocarosis, a significant zoonosis that can lead to visceral, ocular and neurological larval migrans as well as the condition known as covert toxocarosis. Despite the ocular form of the disease having a relatively high public profile, and there having been extensive research into *Toxocara* spp, aspects of the aetiology and transmission of infection remains unknown and human clinical cases continue to be recognised in the UK year on year. This article describes the epidemiology of infection and resulting disease syndromes as well as considering possible control measures.

Key words: Toxocarosis, zoonosis, anthelmintics, cats, dogs

Introduction

Toxocara spp are a group of intestinal nematodes including species that infect dogs (*T.canis*) and cats (*T.cati*). They are the most common nematodes seen in small animal practice and one of the few companion animal parasites likely to be known by name to the general public. The notoriety of these helminths comes not from the disease they cause in pets but from their zoonotic potential. Many clients will ask their vet about the risks of exposure to the parasite and its consequences, and as a result a responsibility to give accurate preventative advice falls to veterinary practitioners.

Human toxocarosis can present as a variety of syndromes and exposure can occur in a number of different ways. Despite extensive research, there is much about the parasite that remains unknown and some aspects of transmission to people that remain a mystery. This article provides a review and update on the epidemiology, clinical signs and prevention of human toxocarosis.

Life cycle and transmission in cats and dogs

The life cycle for *T.canis* is shown in Figure 1. Adult worms (Figure 2) live in the small intestine and shed eggs into the environment via the faeces of the host. The eggs when first shed are unembryonated (Figure 3) and are not infective. Progression to the infective embryonated L3 stage is required for infection, so fresh faeces do not present a zoonotic risk. The morula of the ovum is at first undifferentiated (Figure 4) and larval development in the environment takes place in two to seven weeks under optimum conditions. Although dogs may be infected by ingesting embryonated eggs, the most important route of canine infection is trans-placental. As a result, prevalence of infection in pups born to untreated dams can reach close to 100%. Dogs may also become infected by trans-mammary infection or consuming paratenic hosts such as rodents. The latter is more important in *T.cati* transmission where the feline host frequently hunts and trans-placental transmission does not occur. Trans-mammary infection ensures high prevalence in puppies and kittens in the absence of anthelmintic regimes.

As cats and dogs age they develop a degree of immunity to the parasite which reduces the chances of worms producing eggs and as a result the prevalence of patent infection in adult pets is frequently less than 20%. This can vary substantially, with prevalence of *T.canis* in Western Europe varying between 3.5 and 34% and *T.cati* between 8 and 76% (Overgaauw and Van Knapen, 2013). Populations with certain lifestyles such as strays and hunting pets can be expected to have a higher prevalence. This prevalence is not static, with shedding of ova being intermittent, so the potential for adult pets to be reservoirs of infection should not be underestimated. Although prevalence and intensity of infection of *T.canis* in foxes is high, their role in environmental contamination has not been fully quantified, but it is thought to be less than 10% of that of dogs. This is due to there being far fewer foxes than dogs in most populated areas.

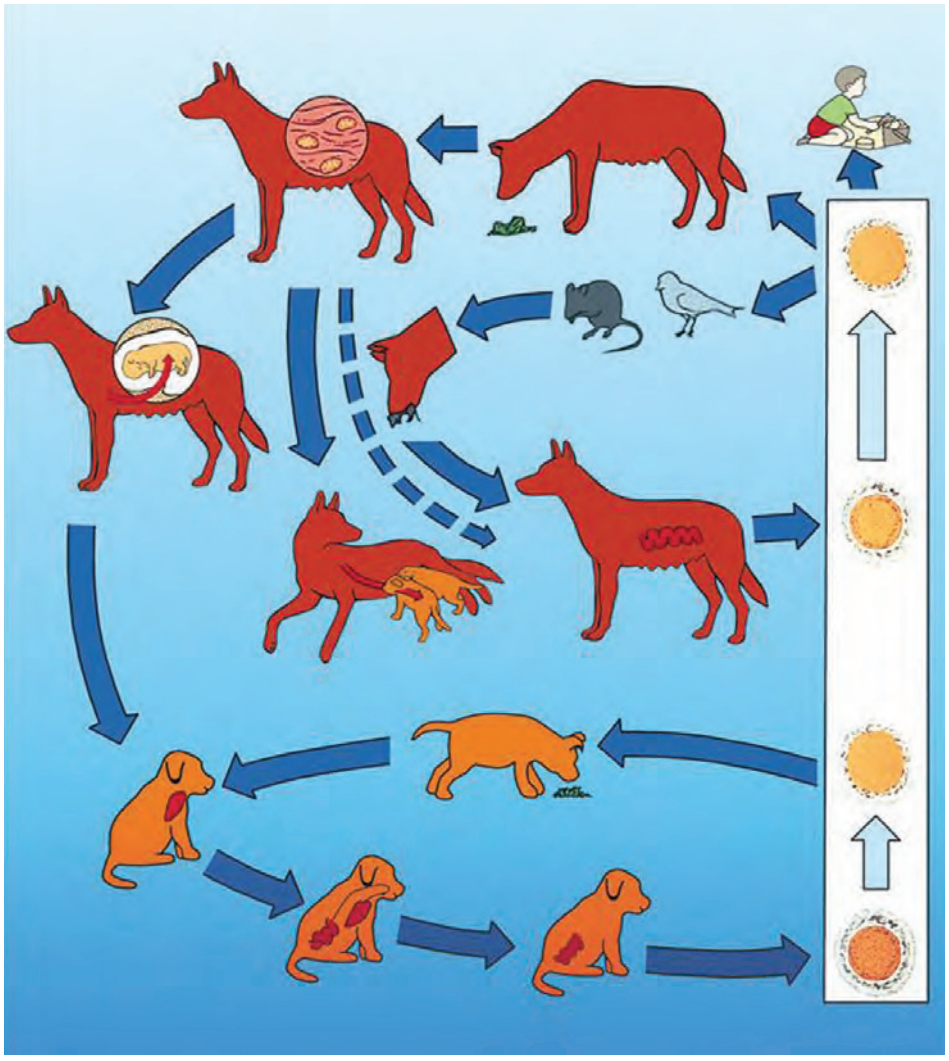

Figure 1: Toxocara canis life cycle (courtesy Bayer)

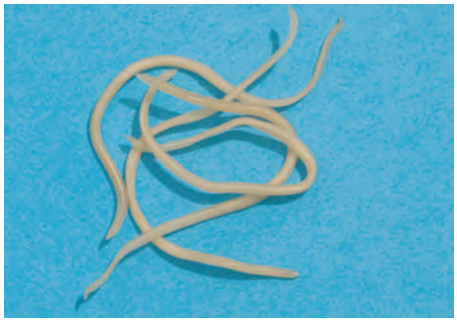

Figure 2: *Toxocara* spp adults

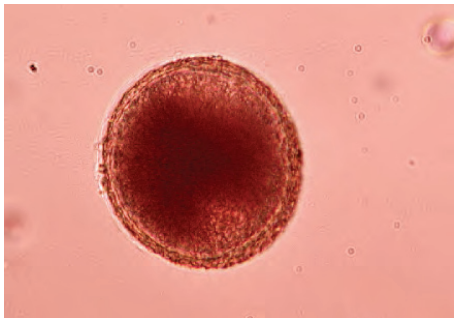

Figure 3: *Toxocara* spp ova

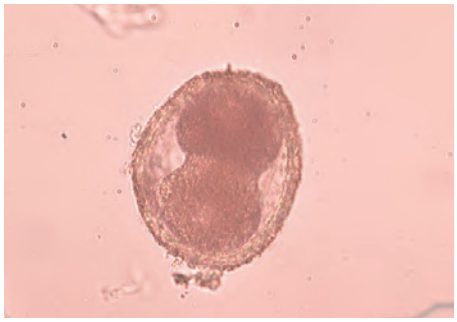

Figure 4: Embryonating *Toxocara canis* ova

Zoonotic transmission

Although it has been proposed that people can be infected by eating the undercooked meat of paratenic hosts such as wild game (Sturchler, Weiss, Gassner, 1990), the most common route of human infection is by the ingestion of embryonated eggs. It was originally thought that *T.canis* alone was the source of human infection by this route but there is now strong evidence to suggest that *T.cati* is significantly involved as well (Fisher, 2003). Zoonotic infection through oral ingestion of embryonated eggs can occur through the following routes:

- **Geophagia** - Many studies have been carried out in the UK and around the world showing that embryonated eggs are present in the soil of gardens, parks and children's play areas (Uga, 1993; Kirchheimer & Jacobs, 2008). Soil provides a more suitable environment than fresh faeces for this process as the eggs need to be shielded from harmful UV light and desiccation. Soil may be ingested accidentally or deliberately, especially by children. Sand pits/boxes are often found to be contaminated by *T.cati* eggs, forming a potential contact point for children playing in these areas.
- **Pica** – *Toxocara* spp eggs may be transferred onto objects such as unwashed raw fruit and vegetables that are subsequently ingested, or onto toys that are placed into the mouth by children.
- **Direct dog contact** – a number of studies have found embryonated *Toxocara* spp eggs in the coat of dogs (Wolfe & Wright, 2003, Roddie, Stafford, Holland et al 2008), suggesting that transmission may occur through direct contact with the coat of dogs. It has been demonstrated subsequently that *T.canis* eggs can embryonate in dog fur, but at a lower rate than in soil (Keegan & Holland, 2012). The potential for embryonation and the presence of embryonated eggs in dog fur means that prolonged direct contact and poor hygiene around dogs represents an as yet unquantified but potentially significant transmission risk.

A combination of these routes has led to significant numbers of people being exposed to the parasite, with surveys across Europe showing that between 2 and 31% of people have antibodies to the parasite, but fortunately incidence of clinical disease is relatively low.

Currently approximately 2 cases per million people are reported in the UK each year. However, it is likely that some cases go undiagnosed each year due the wide variety of clinical presentations in people. Cases may also go unreported as toxocarosis is not a notifiable disease in England and Wales and national data is based on voluntary reporting of infections to the Health Protection Agency (HPA).

The most at risk group in people are children, commonly between 2 and 4 years of age. This may be due to poorer hygiene, pica and geophagia in this group, or a greater susceptibility to infection. Adult infections are also seen, and so toxocarosis should not be viewed as a disease solely of children.