Toxocariasis: A Neglected Parasitic Disease with Public Health Importance

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Abstract: Toxocariasis is a parasitic disease with zoonotic potential. The causative agent, Toxocara canis, is transmitted to humans through ingestion of embryonated eggs. The eggs can survive in the environment for a long time and infect various hosts, including humans. The parasite can cause both visceral (VLM) and ocular manifestations (OLM) in human beings. VLM is characterized by larval migration in the tissues and can cause significant clinical signs, such as fever, abdominal pain, and neurological symptoms. OLM is predominantly associated with ocular larva migrans, which can cause blindness and neurological impairment. The diagnosis of toxocariasis is often challenging due to its non-specific symptoms and the lack of definitive diagnostic tests. The disease has important public health implications, as it affects individuals of all ages and can cause significant morbidity and mortality. The treatment of toxocariasis is often empirical and may vary depending on the severity of the infection. Further research is needed to improve our understanding of the disease and develop more effective diagnostic and therapeutic strategies.
It seems the damages to the affected organs and CNS is due to the inflammatory reactions induced by the larvae [16,24]. The larvae produce glycosylated proteins inducing production of IL-5 and CD4-TH2 response which eventually promote vascular adhesion and eosinophilic infiltration [16,25]. Eosinophilia is a common finding in blood and/or the cerebrospinal fluid (CSF) of toxocariasis cases [16,22,26]. It has been shown that in cerebral T. canis infections, the release of cytokines such as interleukin (IL) 5 and interferon γ (IFN-γ) and inducible nitric oxide synthase (iNOS) is induced [22,24,26]. Various cells in the CNS including neurons, astrocytes, oligodendrocytes and microglia possess receptors of these cytokine [24,26]. The presence of IL-5 in the CNS can lead to the infiltration of eosinophils and subsequent degranulation of these cells results in the release of toxic mediators causing destruction of surrounding cells [22,26]. Intense release of cationic proteins from the eosinophil granules that are toxic to endothelial cells has been reported as a possible cause of these lesions [25]. It has been demonstrated that INOS exerts deleterious effects on the murine brain during infection with T. canis [24,26]. On the other hand, the up-regulation of IFN-γ in the CNS can result in activation of macrophages and microglia increasing nitric oxide production and subsequent tissue damage [23,26].

However, T. canis in most instances is regarded as the main cause of human toxocariasis [3,8], nonetheless, the risk of the disease caused by T. cati should not be underestimated or ignored. Therefore, the infection risk for humans with T. cati should be considered at least as high as that with T. canis so that cats are more likely to contaminate places like gardens due to their defecation habits [23].

Because the clinical signs and symptoms of toxocariasis are non-specific, definitive diagnosis of the disease is a challenge. On the other hand, since poly-parasitism is common in tropical countries, diagnosis of VLM and CT cases is difficult. Generally, diagnosis of toxocariasis cases is based on history, clinical signs, various imaging techniques such as ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI), biopsy and subsequent histopathological examination [8,18]. Beside serological techniques such as the indirect enzyme-linked immunosorbent assay (ELISA) on the basis of the excretory-secretory antigens of the third-stage larvae (L3) of T. canis, immunohistochemistry and molecular-based methods such as PCR can be helpful [8,13,18]. Although the diagnostic tests for VLM are immunological, they may not be reliable for OLM [10]. In OLM cases, ophthalmologic examination should be noted [4,10]. In the VLM cases, multiple oval hypoechoic lesions in the liver in sonographic examination and multifocal hepatic lesions present in the images from CT or MRI can be helpful in diagnosis [4]. Detection of the anti-T. canis antibodies in vitreous or aqueous humor is helpful in confirming early diagnosis of the OLM patients [4,10]. In addition, ocular ultrasound, fluorescein angiography, CT and optical coherence tomography can be useful [4]. Diagnosis of NT patients is usually based on high serum titers of Toxocara spp. antibodies, anti-T. canis antibodies in the CSF and eosinophilia in the CSF and/or blood, and close contact with dogs and cats [4,22]. In addition, the clinical and CT or MR imaging findings as well as the normalization of the CSF parameters during treatment can support and confirm the early diagnosis [16,22]. Multifocal, circumscribed granulomatous lesions in CNS with strong contrast enhancement or a combination of circumscribed and diffuse changes in chronic cases may be non-specific MR imaging findings [4,22]. Angiography may confirm cerebral vasculitis in the NT cases [22]. In the NT cases, a list of diseases that can infect the CNS should be provided to make a differential diagnosis [4].

Severity and location of the lesions are important factors in selecting a suitable drug in toxocariasis treatment [1,3,4]. Albendazole is the choice for the treatment of toxocariasis in patients affected with VLM, CT or NT, and potent larvicides such as thiacetamide and diethylcarbamazine can also be effective in inhibiting larval migration [3,4,8]. Mebendazole is the second-line treatment for toxocariasis, whereas its gastrointestinal absorption is poor [10]. In addition, because the chronic inflammatory reactions by infiltration of eosinophils, lymphocytes, plasma cells and macrophages are more common than abscess formation in the CNS, corticosteroids are thought to be efficient as symptomatic treatment [19]. Treatment of the OLM cases is based on delicate ophthalmic procedures or even vitrectomy, anthelmintic chemotherapy and corticosteroids [4,10].

Wide ranges of the definitive and paratenic hosts and multiplicity of the transmission routes of Toxocara species complicate the control, prevention and eradication of the parasite [4]. The high prevalence of the causative parasite in dogs and cats and also difficulties in preventing environmental contamination and human infection highlight its great importance as a zoonosis. Considering the high prevalence of toxocariasis in children, it is necessary to pay attention to the education of children and also the public. Proper cooking of foods can prevent the accidental ingestion of eggs. It should be noted that viable larvae of T. canis as well as T. cati have been found in meat even after prolonged periods of freezing [7,23]. Good hygiene practices should be encouraged and proper strategies should be designed and applied to prevent transmission of Toxocara spp.. Furthermore, probable relationship between toxocariasis and the global burden of epilepsy should be noted in establishing preventive measures. The importance of toxocariasis and persistent of the infective Toxocara larvae in meat should not be considered as neglected as previously thought. It should be added that veterinarians play an important role in combating the spread of Toxocara infection in places where a large number of dogs and cats are accompanied with pet owners. Regular stool examination and frequent chemotherapy of pets with albendazole or mebendazole can be effective in reducing the eggs number deposited in soil, therefore controlling the disease. In addition, control programs such as reducing the number of pet animals or limiting contacts of small children with them appear to be helpful. Control of the spread of feces of dogs and cats can help in controlling toxocariasis infection. Unfortunately, there is no vaccine available and an appropriate specific control program and development of proper vaccines against this zoonotic disease remain a challenge. Rapid identification and diagnosis of the larvae in paratenic hosts such as humans and development of an effective vaccine are essentials and basic requirement in designing any control program.

References


