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ORIGINAL ARTICLE

Retrospective Study

Clinical characteristics and progression of liver abscess caused by toxocara

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Abstract

AIM: To evaluate the clinical characteristics and progression of liver abscess caused by toxocara.

METHODS: We retrospectively reviewed the medical records of patients with serum IgG antibody to *Toxocara canis* and liver abscess diagnosed using abdominal computed tomography between February 2010 and February 2015. Among 84 patients exhibiting serum IgG antibody to *Toxocara canis*, 34 patients were diagnosed with liver asbscess and treated with albendazole. A follow-up period of 1 year was conducted.

RESULTS: Mean patient age was 53 (34-79) years, with 26 (76.5%) patients being male. Twenty-one (61.7%) patients were moderate or heavy drinkers, 23 (67.6%) patients had a history of eating raw meat or liver and 6 (17.6%) patients owned pet dogs or cats. Main patient symptoms consisted of right upper quadrant pain, fever, and fatigue; 18 (52.9%) patients, however, presented with no symptoms. Lung involvement was detected in 444 (11.7%) patients. The eosinophil count increased in 29 (85.3%) patients at initial diagnosis, and decreased in most patients after albendazole treatment. The initial serum IgE level increased in 25 (73.5%) patients, but exhibited various response levels after albendazole treatment. Liver abscess formation improved in all patients.

CONCLUSION: The liver abscess was improved with albendazole treatment.

Key words: Toxocariasis; Liver abscess; Eosinophilia

Core tip: This is a retrospective study to evaluate the clinical characteristics and progression of liver abscess caused by toxocara. Eating uncooked food was a more common route of infection than contact with pet animals. Alcohol consumption, sex (male), and ingestion of raw meat or liver were considered to be significant risk factors for toxocariasis. Patients can present with no specific symptoms, eosinophilia, and/or increased levels of serum IgE. Liver abscess caused by toxocara has characteristic radiologic findings. Even if a few patients experience relapse or migration of abscess posttreatment, a good prognosis exists for the overall clinical course.

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INTRODUCTION

Toxocariasis is a parasitic infection caused by *Toxocara canis* or *Toxocara cati*. It is known as a main cause of eosinophilia[1]. Clinical manifestations of toxocariasis range from asymptomatic infection to involvement of various organs. Visceral larva migrans (VLM) means toxocara infection associated with various internal organs of the body[2]. Liver abscess represent one type of VLM, which differs from pyogenic liver abscess in displaying specific histologic and radiologic findings[3,4]. Hepatic VLM or liver abscess caused by toxocara can occasionally be detected as an abnormal finding at ultrasonography screening and therefore be misdiagnosed as a malignancy in patients with chronic liver disease or a history of other cancer(s)[5]. A thorough understanding of the clinical characteristics and progression of hepatic VLM or liver abscess caused by toxocara is necessary in order to determine potential factors that may help improve diagnosis, as well as avoid unnecessary testing and improper disease treatment.

MATERIALS AND METHODS

We retrospectively reviewed the medical records of patients with serum IgG antibody to *Toxocara canis* and liver abscess diagnosed by abdominal computed tomography (CT) at Daegu Catholic University Hospital between February 23, 2010 and February 24, 2015. We investigated patients about a history of moderate or heavy alcohol consumption, raw meat or cow's liver ingestion, and owning pet dogs or cats. We obtained liver transaminase levels, peripheral blood eosinophil counts, serum IgE levels, hepatitis B surface antigen and antibody and anti-hepatitis C virus antibody results. In addition, we obtained any history of underlying disease and other organ(s) involvement. Eosinophilia was defined as an absolute peripheral blood eosinophil count $\geqslant$ 500/μL. Elevated serum levels of IgE were defined as IgE levels $\geqslant$ 100 IU/mL. We treated patients with liver abscess with 400 mg orally twice daily for 5 d. The follow-up protocol consisted of obtaining repeat eosinophil counts and serum IgE levels, as well as performing abdominal CT scans at various intervals for 1 year.

RESULTS

Among a total of 84 patients exhibiting serum IgG antibody to *Toxocara canis*, 34 patients were diagnosed with liver abscess. Mean patient age was 53 years, with serum IgG antibody to *Toxocara canis* being three times more prevalent in men than in women (Table 1). Twenty-three (67.6%) patients had a history of eating raw meat or liver and 6 (17.6%) patients owned pet dogs or cats (Table 1). Four patients had no specific history of eating uncooked food or owning pet animals. Main patient symptoms consisted of right upper quadrant pain, fever, and fatigue. Eighteen (52.9%) patients were asymptomatic (Table 1). Five patients revealed involvement of other organs including the lung, a leg muscle, and the brain in addition to liver involvement (Table 1). One of four patients with lung involvement demonstrated concomitant brain involvement. Aspartate transaminase and alanine transaminase levels were normal in all patients except one who had alcoholic hepatitis. Twenty-nine (85.3%) patients initially presented with eosinophilia. Among these 29 patients, 17 had mild eosinophilia, 7 had moderate eosinophilia, and 5 had severe eosinophilia (Table 1). Twenty-five of 26 patients who had repeat serum IgE levels had initially increased IgE levels (Table 1). The remaining patient demonstrated an upper normal serum IgE level of 99 IU/mL. Liver abscess on dynamic CT included multiple lesions in 19 patients and a single lesion in 15 patients (Table 1). The lesions were seen as ill-defined, low-attenuating, oval nodules. They were faintly seen on arterial and equilibrium phase images and best seen on the portal venous phase. All of these 34 patients were treated with albendazole. After treatment, the eosinophil count was normal in 16 patients, decreased in 8, and remained the same in one (Table 2). The eosinophilic response pattern was divided into two groups: Continuously decreasing (15 patients, 62.5%) and fluctuating (9 patients, 37.5%). We were unable to evaluate the eosinophilic response in 9 patients. Among those patients, 5 had normal eosinophil counts at initial diagnosis and 4 did not participate in the follow-up protocol posttreatment. Fifteen of 24 patients who showed an eosinophilic response did so within 1 mo posttreatment. Six months after treatment, the serum

Table 1 Baseline characteristics of patients with liver abscess caused by toxocara

Patients, *n*	34
Mean age, yr	53
Male, *n* (%)	26 (76.5)
Underlying disease, *n* (%)	
Hypertension	9 (26.5)
Diabetes	4 (11.8)
Tuberculosis	3 (8.8)
Liver cirrhosis	2 (5.9)
Chronic viral hepatitis	2 (5.9)
Cancer history	2 (5.9)
None	9 (26.5)
Alcohol drinking, *n* (%)	
Heavy drinking	14 (41.2)
Moderate drinking	7 (20.6)
No drinking	9 (26.5)
Unknown	4 (11.8)
Transmission, *n* (%)	
Eating raw meat or liver	23 (67.6)
Keeping pet dogs or cats	6 (17.6)
No specific history	4 (11.8)
Unknown	7 (20.6)
Symptoms, *n* (%)	
Asymptomatic	18 (52.9)
RUQ pain	6 (17.6)
Fever	4 (11.8)
Fatigue	4 (11.8)
Anorexia	2 (5.9)
Cough	2 (5.9)
Weakness of legs	2 (5.9)
Involvement of other organs, *n* (%)	
Lung	4 (11.8)
Muscle of legs	1 (2.9)
CNS	1 (2.9)
Mean AST/ALT, IU/L	31/31
Eosinophilia, *n* (%)	
Normal (< 500/μL)	5 (14.7)
Mild (500-1500/μL)	17 (50.0)
Moderate (1500-5000/μL)	7 (20.6)
Severe (> 5000/μL)	5 (14.7)
Serum IgE, *n* (%)	
Normal (< 100 IU/mL)	1 (2.9)
Mild elevated (100-500 IU/mL)	10 (29.4)
Severe elevated (> 500 IU/mL)	15 (44.1)
Unknown	8 (23.5)
Liver abscess, *n* (%)	
Single	15 (44.1)
Multiple	19 (55.9)

Liver abscess caused by toxocara was related to sex (male), alcohol drinking, eating raw meat or liver. Laboratory characteristics showed normal liver enzymes, peripheral blood eosinophilia, and elevated level of serum IgE. RUQ: Right upper quadrant; CNS: Central nervous system; AST: Alanine aminotransferase; ALT: Aspartate aminotransferase.

IgE level increased in 7 patients, decreased in 8, and remained the same in 3 (Table 2). We were unable to evaluate the serum IgE response in 16 patients. Among these patients, 8 patients did not undergo check serum IgE level tests initially and the other 8 patients did not participate in the follow-up protocol. A follow-up CT was performed for 22 patients. Among these patients, 15 demonstrated disappearance of liver abscess within 3 mo and 21 within 6 mo. Relapse or migration of liver abscess was observed in 3 patients.

Table 2 Therapeutic response after treatment with albendazole *n* (%)

Eosinophilia (*n* = 25)	
Normalized	16 (64)
Decreased	8 (32)
No change	1 (4)
Serum IgE (*n* = 18)	
Increased	7 (38.9)
Decreased	8 (44.4)
No change	3 (16.7)
Liver abscess (*n* = 22)	
Improved	22 (100)
Not improved	0

Most eosinophil counts were normalized or decreased and all of the abscesses were improved on computed tomography after 1 year, but the levels of serum IgE showed variable response after 6 mo.

DISCUSSION

Toxocariasis is a worldwide disease. The overall seroprevalence of toxocariasis has been reported as 13.9% in Unites States[6], 2%-5% and 14%-37% respectively in the urban and rural areas of France[7], 18% in China, 20% in Malaysia, 68% in Indonesia, and 81% in Nepal[8]. In South Korea the seroprevalence has been reported as 5% in Gangwon-do[9], 6% in Seoul, and 11% in Gyeongsangnam-do[10]. The seroprevalence of toxocariasis in patients with eosinophilia has been reported as 64.9%-86.7% in Seoul[8,11], 50.5% in Chungcheongnam-do[12], and 62% in Pohang[13]. These reports confirm that toxocariasis is known to be a main cause of eosinophilia. Toxocara infection is caused by ingestion of embryonated eggs from the soil and pet animals or by ingestion of encapsulated larva while eating uncooked paratenic hosts[14]. In this study, eating uncooked food was a more common route of infection than contact with pet animals (67.6% *vs* 17.6%). Choi *et al*[8] suggested that ingestion of raw cow liver was related to an increased risk of toxocariasis, but not ingestion of raw meat or animal blood and owning dogs. Based on the results of our epidemiologic study, demonstrating that men are three times more susceptible to toxocariasis than women, and revealing that approximately 60% of the patients consumed alcohol, we consider sex (male) and alcohol consumption as risk factors for toxocariasis.

The most commonly utilized serologic test for toxocariasis is the detection of the serum IgG antibody to the toxocara excretory/secretory antigen (TES Ag) with a toxocara ELISA kit (Bordier Affinity Products, Crissier, Switzerland)[15]. Eosinophilia, elevated serum IgE levels or increased eosinophil cationic protein is helpful for the diagnosis of active toxocariasis[16-18]. Although the toxocara ELISA test possesses high sensitivity and specificity[15], the test cannot differentiate present from past infections[16] and may produce cross-reactivity with other parasites such as *Clonorchis sinensis*, *Sparganum*, *Fasciola hepatica*, and *Paragonimus westermani*[2]. Infected larva can penetrate the intestinal wall through vessels and invade various organs such as the liver, lung, muscle,

eye, heart and central nervous system, *etc*[19,20]. We investigated other organ(s) involvement in 84 patients who had the IgG antibody for *Toxocara canis*, and found the organs involved, displayed in order of frequency, were the liver (40.5%), lung (27.4%), eye (8.3%), skin (3.6%), muscle (1.2%), and brain (1.2%). Lung involvement occurred in 11.8% of patients with liver abscess (Table 1). This occurrence, therefore, creates the necessity of assessing the possibility of lung involvement in patients with liver abscess caused by toxocariasis. TES Ag secreted from the epicuticle of the moving larva causes an immune reaction, which produces increased serum IgE and eosinophilia[21]. Liver abscess, histologically described as eosinophilic abscess or granuloma, results from eosinophilic inflammation which develops when larva remain in the liver[22].

Approximately 50% of patients were asymptomatic. A small number of patients had right upper quadrant pain, fever, and fatigue (Table 1). It remains impossible to rule out liver abscess in patients with toxocariasis using only symptom information. In contrast to patients with hepatic visceral larva migrans or liver abscess caused by toxocara, approximately 90% of patients with pyogenic liver abscess have fever and approximately 70% have abdominal pain[23]. The possibility of abscess caused by toxocara must be considered if liver abscess is inadvertently detected upon abdominal ultrasonography during routine medical exams. CT finidngs of liver abscess caused by toxocara usually include lesions that measure approximately 1-1.5 cm in diameter; possess an oval shape, obscure margin, multiplicity, and hypodensity[3]. In contrast to hepatocellular carcinoma, CT finindgs for liver abscess include lesions that are regular, not round, and striking at portal venous phase[24]. We can confirm the CT findings cited in this study; however, one finding that differs from the previous study[24] is that data from this study reveal that a relatively high number of patients with single abscess existed.

Toxocariasis is a self-limiting disease; therefore, patients with mild symptoms do not necessarily require medication[2]. However, if patients have moderate or severe symptoms due to visceral larva migrans, they should be treated with albendazole[24]. Previous literature has recommended treating liver abscess regardless of symptom status because, compared with the control group, the albendazole group demonstrated accelerated liver abscess healing[5]. Twenty-four of 25 patients who presented with eosinophilia and had been treated with albendazole displayed decreased eosinophil counts. Fifteen of these patients (62.5%) had checked their eosinophil count within 1 mo posttreatment. All patients experienced decreased eosinophil counts. Previous literature has reported an eosinophilic response occurred 1 mo posttreatment[16]; therefore, we concluded that the eosinophilic response could be evaluated 1 mo posttreatment. In addition, if the eosinophilic count initially decreases, but continually increases during the posttreatment period, relapse or migration of lesions should be considered. Transient eosinophil count fluctuations, which can occur among eosinophilic response patients as observed in this study, must also be considered. Abdominal CT and repeat eosinophil counts at follow-up can help distinguish relapse or migration from eosinophilic fluctuation. Repeat serum IgE levels at follow-up provides an inadequate evaluation measurement of treatment response because serum IgE responds unpredictably[16]. CT follow-up was performed within 3 mo for 68.2% of patients and liver abscess disappeared in all of them. We therefore concluded that CT scan results could be evaluated 3 mo posttreatment. We encountered relapse or migration of lesions in three patients at 4, 6 and 8 mo posttreatment. Eosinophilia developed in only one of these patients, while the other two experienced continuously decreasing eosinophil levels despite relapse or migration of lesions. Two of these three patients were retreated with albendazole, while the other was only observed. Subsequently, all lesions of all three patients disappeared. If this phenomenon is observed posttreatment, the possibility of reinfection also needs to be considered. No evidence exists confirming that patients who are experiencing relapse or migration of liver abscess, regardless of clinical symptoms or eosinophilia, should be retreated with albendazole. It is reasonable, however, to retreat relapsed or migrated lesions with albendazole because albendazole is inexpensive, easily available over the counter and has no significant side effects. Existence of toxocara-specific IgG antibody can persist for years after the disappearance of liver abscess. One study reported that the mean duration of IgG antibody existence in the body was 2.7 years[25]. IgG antibody detection was conducted at 3, 9, 18, 24 mo and 5 years each in five patients from this study. All patients persistently displayed IgG antibody during the follow-up period, therefore, excluding detection of serum IgG antibody testing from the follow-up protocol[16].

The study has limitations as a retrospective study, so our recommendations about the evaluation measurement of treatment response are based on the literature data and not on the results of this study.

Liver abscess caused by toxocara is a disease resulting from the ingestion of uncooked food, which causes an immune reaction in the liver. Patients can present with no specific symptoms, eosinophilia, and/or increased levels of serum IgE. Toxocariasis has characteristic radiologic findings and may involve other organs such as the lung. Treatment of toxocariasis consists of taking albendazole for 5 d. After treatment, the eosinophil count starts to decrease within 1 mo and the abscess begins to disappear within 3 mo as displayed on CT scan. Complete disappearance of liver abscess can occur after 1 year. Even if a few patients experience relapse or migration of abscess posttreatment, a good prognosis exists for the overall clinical course of this disease.

COMMENTS

Background

Toxocariasis is a parasitic infection caused by *Toxocara canis* or *Toxocara cati*. It is known as a main cause of eosinophilia. Clinical manifestations of

toxocariasis range from asymptomatic infection to involvement of various organs. Liver abscess caused by toxocara can occasionally be detected as an abnormal finding at ultrasonography screening and therefore be misdiagnosed as a malignancy in patients with chronic liver disease or a history of other cancer(s). The authors evaluated the clinical characteristics and progression of liver abscess caused by toxocara.

Research frontiers

This study contributes to determining potential factors that may help improve diagnosis of liver abscess caused by toxocara, as well as avoid unnecessary testing and improper treatment.

Innovations and breakthroughs

In this study, all patients (62.5%) who had checked their eosinophil count within 1 mo posttreatment experienced decreased eosinophil counts. And all patients (68.2%) who had checked computed tomography (CT) follow-up within 3 mo posttreatment experienced disappearance of liver abscess. Therefore, the authors concluded that the eosinophilic response could be evaluated 1 mo posttreatment and CT scan could be evaluated 3 mo posttreatment.

Applications

Human toxocariasis can clinically present as liver abscess. If a patient with a history of eating raw meat or liver presents peripheral eosinophilia and abnormal liver imaging, liver abscess caused by toxocara should be considered for diagnosis.

Terminology

Toxocariasis: An infection transmitted from animals to humans caused by the parasitic roundworms commonly found in the intestine of dogs (*Toxocara canis*) and cats (*Toxocara cati*).

Peer-review

Studies exploring toxocariasis in liver abscess have been infrequent. The author of this paper evaluated the clinical characteristics and progression of liver abscess caused by toxocara. This study is useful for diagnosing and monitoring the disease in the clinical practice.

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