HUMAN TRICHOSTRONGYLIASIS: A HOSPITAL CASE SERIES

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Abstract. *Trichostrongylus* is a common nematode found to infect livestock throughout the tropics and can cause accidental zoonosis in humans. In the Lao PDR and Thailand, cases of human trichostrongyliasis have been reported sporadically but clinical data are limited. We retrospectively reviewed 41 cases of trichostrongyliasis who presented to Srinagarind Hospital, Thailand from 2005 to 2012. The diagnosis of trichostrongyliasis was made by finding their eggs in the stool of patients. Of the 41 cases reviewed, 30 were Thais and 11 from the Lao PDR; their age range was 26-86 years. Fifty-eight point five percent of the cases were male, 56.1% had a primary school or a lower education level, 56.1% were farmers or laborers, 63.4% lived in a rural area and 95.1% had underlying disease. Twenty-one patients were co-infected with *Opisthorchis viverrini* (14/21; 66.7%) and *Strongyloides stercoralis* (10/21; 47.6%) while the remaining (*n*=20) had a single infection with *Trichostrongylus* only. All the trichostrongyliasis only patients who had underlying disease not related to the gastrointestinal (GI) tract had normal bowel habits and normal grossly appearing stool. GI symptoms, such as abdominal pain, flatulence, bloating, nausea, vomiting, anorexia, diarrhea and constipation, were not found in these patients suggesting they had a light infection. This study is the first report of the clinical features of a trichostrongyliasis case series from tertiary care hospital in Thailand.

Keywords: human trichostrongyliasis, clinical feature, hospital base

INTRODUCTION

Trichostrongylus spp are a common helminthes infecting the digestive tract of herbivorous animals, especially livestock, and are found throughout the world (Yong *et al*, 2007). Most species cause accidental infection in humans, but a few can cause considerable clinical and public health problems (Beaver *et al*, 1984). Human trichostrongyliasis has been reported sporadically from Africa and in many other plases, such as Iran, Lao PDR, Thailand, South Korea, China, the United States of America and Australia (Ghadirian and Arfaa, 1975; Beaver *et al*, 1984; Panasoponkul *et al*, 1985; Jariya *et al*, 1988; Boreham *et al*, 1995; Gutierrez *et al*, 2006; Sato *et al*, 2011). *Trichostrongylus orientalis*, *T. colubriformis*,

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T. vitrinus, T. axei, T. capricola, T. probolulus, and *T. skrijabini* have been reported to infect humans (Ghadirian and Arfaa, 1975) while *T. colubriformis* and *T. axei* have been found in Thailand and the Lao PDR (Panasoponkul *et al*, 1985; Sato *et al*, 2011; Phosuk *et al*, 2013). Adult *Trichostrongylus* spp are small nematodes (Yong *et al*, 2007). Human trichostrongyliasis is acquired through consumption of food or water contaminated with animal feces, commonly where feces are used as fertilizer (Watthanakulpanich *et al*, 2013). After reaching the small intestine, the larvae mature in 3-4 weeks and lay eggs. *Trichostrongylus* spp eggs have an elongated oval shape, a hyaline shell and the ends are more pointed than hookworm eggs (Sato *et al*, 2011). *Trichostrongylus* eggs are 75-95 x 40-50 μm in size (Sato *et al*, 2011) while hookworm eggs are oval have broadly rounded ends and have an average size of 60-75 x 35-40 μm (Beaver *et al*, 1984). The morphology of *Trichostrongylus* and hookworm eggs are similar, but the two can be differentiated by a parasitologist (Sato *et al*, 2011). Population movements may affect parasite distribution. The symptoms of trichostrongyliasis include abdominal pain, diarrhea, weakness, leukocytosis and eosinophilia (Wallace *et al*, 1956; Wall *et al*, 2011). Hospital data regarding human trichostrongyliasis in Thailand is lacking and the clinical features of only one case have been published (Panasoponkul *et al*, 1985; Jariya *et al*, 1988). This study aims to describe the demographics and clinical features of 41 human trichostrongyliasis cases.

MATERIALS AND METHODS

Study samples

The results of stool examinations using a standard formalin ethyl acetate concentration technique (Elkins *et al*, 1986) from 19,923 patients receiving medical treatment at Srinagarind Hospital from 2005 to 2012 were reviewed. Srinagarind Hospital is a 1,000-bed tertiary-care facility in Khon Kaen, Thailand. The medical records of 41 patients diagnosed with trichostrongyliasis based on stool examination were reviewed. This study was approved by the Khon Kaen University Ethics Committee for Human Research (HE551011).

Data analysis

The medical records of 41 patients with trichostrongyliasis were reviewed for demographic characteristics, gender, age, education level, occupation and history of underlying disease. The date of sample collection was used to classify samples as obtained during the wet season (May to October) or the dry season (November to April). The characteristics of gastrointestinal (GI) signs and symptoms, such as abdominal pain, flatulence, bloating, skin rash and diarrhea were recorded. GI symptoms caused by underlying diseases, bacterial infections and/or other parasitic co-infections were excluded. Fecal macroscopic and microscopic examination results and occult blood tests were reviewed. Hemoglobin and hematocrit levels were reviewed to determine the presence of anemia. The percent eosinophilia and absolute eosinophil counts were recorded.

Statistical analysis

The data were recorded and, then analyzed using the statistical package for the social sciences (SPSS), version 17.0 (IBM, Armonk, NY).

RESULTS

The overall trichostrongyliasis rate during 2005-2011 was 0.21% (41/19,923

Table 1
Prevalence of *Trichostrongylus* spp eggs in stools by year.

Years	Number of stool samples (% of total)	Number of stool samples positive for *Trichostrongylus* eggs (%)
2005	1,485 (7.45)	2 (0.13)
2006	1,998 (10.03)	2 (0.10)
2007	2,086 (10.47)	7 (0.34)
2008	2,204 (11.06)	1 (0.05)
2009	2,342 (11.76)	4 (0.17)
2010	2,606 (13.08)	7 (0.27)
2011	3,341 (16.77)	9 (0.27)
2012	3,861 (19.38)	9 (0.23)
Total	19,923 (100)	41 (0.21)

Table 2
Characteristics of trichostrongyliasis patients at Srinagarind hospital.

Characteristics	*N*=41
Age range in years: (mean±SD)	26-86 (51.1±13.1)
Male gender	24 (58.5%)
Education level (primary school or lower)	23 (56.1%)
Farmer or laborer	23 (56.1%)
Lived in rural area	26 (63.4%)
Lived in northeastern Thailand	23 (56.1%)
Lived in the Lao PDR	11 (26.8%)
Presented during the rainy season	21 (51.2%)
Had underlying disease	39 (95.1%)

patients) and the yearly rate ranged from 0.05% to 0.34% (Table 1). All the cases were light intensity infection. Thirty cases were from northeastern Thailand and 11 cases were from the Lao PDR (Table 2). Trichostrongyliasis was more common among patients with a lower education level than primary school (56.1%), who worked as farmers and/or laborers (56.1%) and who lived in a rural area (63.4%). The proportions of patients who presented to the hospital during the wet and dry seasons were about the same (21 *vs* 20; patients, respectively) (Table 2). The mean age (± SD) of trichostrongyliasis patients was 51.1 (± 13.1) years and the range was 26-86 years (Table 2). The most common age range for infected patients was 36-46 years (29.3%) (Table 3). The demographic data for Thai and Lao PDR patients were similar (data not shown).

Of the 41 trichostrongyliasis patients, 39 (95.1%) had from 1 to 6 underlying diseases; 56.1% had a single underlying disease and 19.5% has 2 underlying diseases (Table 4). The underlying diseases

Table 3
Trichostrongyliasis patients by age (*N*=41).

Age range (years)	Number (%)
25-35	5 (12.2)
36-46	12 (29.3)
47-57	10 (24.4)
58-68	10 (24.4)
69-79	3 (7.3)
80-90	1 (2.4)

Table 4
Number of underlying diseases found in trichostrongyliasis patients.

Number of underlying diseases	Number of patients (%)
0	2/41 (4.9)
1	23/41 (56.1)
2	8/41 (19.5)
3	2/41 (4.9)
4	3/41 (7.3)
5	1/41 (2.4)
6	2/41 (4.9)

could be classified into 6 groups: chronic diseases (39%), malignancies (29.3%), autoimmune and/or connective tissue diseases (24.4%), viral infections (7.3%), urticarial rashes (7.3%) and other diseases (22.0%) (Table 5).

Twenty-one trichostrongyliasis patients (51.2%) were co-infected with another parasite: 6 had *Opisthorchis viverrini*, another 6 had *Strongyloides stercoralis* and 9 had co-infection with 2 other parasites (*O. viverrini* and hookworm; *O. viverrini* and *S. stercoralis*; *O. viverrini* and *Taenia* spp; *S. stercoralis* and hookworm) (Table 6). Twenty cases (48.8%) had trichostrongyliasis only and of these only one had no underlying disease. The patients had symptoms of flatulence, bloating and anorexia. The blood eosinophils and absolute eosinophil counts were within normal limits. Two patients with trichostrongyliasis only had flatulence and vomiting. The remaining 17 patients with trichostrongyliasis only infection had no diarrhea, abdominal pain, flatulence, bloating, anorexia, nausea, vomiting, fatigue and/or weight loss. The stool examinations of all the patients were negative for stool occult blood. Regarding anemia among patients with trichostrongyliasis only, 3 had missing data and 6 cases had anemia due to underlying diseases. Eleven patients had normal hemoglobin levels with a range of 10.8-14.3 g% (mean ± SD of 12.6 ± 1.1) and hematocrit levels of 33.3-45.4 (mean ± SD of 38.3±3.37). None of the 13 trichostrongyliasis only cases had eosinophilia (mean ± SD percent eosinophilia: 1.7 ± 2.3; range 0-6.5%; AEC ± SD : 127.4 ± 196.2; range : 0-666 cells/mm^3).

DISCUSSION

Trichostrongylus spp primarily infect herbivorous mammals and have a worldwide distribution (Yong *et al*, 2007). The prevalence of human trichostrongyliasis is high among farmers in some developing countries where there is close contact between humans and animals and poor sanitation (Ghadirian and Arfaa, 1975; Beaver *et al*, 1984; Boreham *et al*, 1995; Adams *et al*, 2005; Sato *et al*, 2011). Due to the similar morphology between *Trichostrongylus* and hookworm eggs, human trichostrongyliasis may be misdiagnosed as a hookworm infection, possibly underestimating the number of trichostrongyliasis cases. In the Lao PDR and Thailand, the number of human trichostrongyliasis case reports is limited (Panasoponkul *et al*, 1985; Jariya *et al*, 1988; Sato *et al*, 2011). Only 2 cases reports of human trichostrongyliasis in Thai patients have been published (Panasoponkul *et al*, 1985; Jariya *et al*, 1988).

Table 5
Underlying diseases amoung trichostrongyliasis patients (*N*=39).

Underlying diseases	Case (%)
Chronic diseases[a]	16 (39.0)
Malignancies[b]	12 (29.3)
Autoimmune and/or connective tissue diseases[c]	10 (24.4)
Other diseases[d]	9 (22.0)
Viral infections diseases[e]	3 (7.3)
Urticarial rash	3 (7.3)

[a]Chronic diseases: hypertension, diabetes mellitus, chronic renal failure, nephrotic syndrome, polycystic kidney disease, chronic kidney disease, glomerulonephritis, liver cirrhosis, hyperthyroidism, cerebrovascular accident, ischemic heart disease, herniated nucleus pulposus and glaucoma.
[b]Malignancies: acute myeloid leukemia, lung cancer, breast cancer, cervical cancer, liver cancer, cholangiocarcinoma, esophageal cancer, choriocarcinoma, ovarian tumor, thoracic spine cancer and parapharyngeal tumor.
[c]Autoimmune and/or connective tissue diseases: systemic lupus erythematosus, scleroderma, optic neuritis, idiopathic thrombocytopenic purpura and demyelinating polyneuropathy.
[d]Other diseases: candidiasis, septicemia, septic shock, pneumonia, upper gastrointestinal bleeding, hemorrhoids and benign prostatic hyperplasia.
[e]Viral infections: Ramsay Hunt syndrome, hepatitis B virus induced liver cirrhosis.

Table 6
Parasitic co-infections among patients infected with *Trichostrongylus* spp (*N*=21).

Parasitic co-infections	Number (%)
Co-infection with single parasite (*n*=12)	
Opisthorchis viverrini	6 (28.6)
Strongyloides stercolaris	6 (28.6)
Co-infection with two parasites (*n*=9)	
O. viverrini and hookworm	4 (19.0)
O. viverrini and *S. stercolaris*	3 (14.3)
S. stercolaris and hookworm	1 (4.8)
O. viverrini and *Taenia* spp	1 (4.8)

Sato *et al* (2011) found *T. colubriformis* infections among villagers in the Lao PDR where 43 of 46 stool specimens (93.5%) diagnosed as being hookworm eggs were actually *Trichostrongylus* eggs. This suggests the need to retrospectively review the stool samples of patients diagnosed with having hookworm infection.

From 2005 to 2012, 0.21% of stool samples were positive for *Trichostrongylus* spp at Srinagarind Hospital, and 1.2% to 1.9% of stool samples were positive for hookworm (data not shown). A prevalence of 62%-86.9% was found in one study from central Iran (Ghadirian and Arfaa, 1975). Ghadirian *et al* (1974) found this parasite in domestic animals, such as sheep and goats, and the infective larvae were transmitted to humans. Most livestock in northeastern Thailand are

cows and water buffalo (Chompoochan *et al*, 1998). These animals need to be investigated to determine the prevalence of *Trichostrongylus* spp.

A reason for the low prevalence of trichostrongyliasis in northeastern Thailand could be the dry climate, making it difficult for infective larvae to survive. Fifty-six point one percent of infected persons in our study were farmers and/or laborers, 63.4 % lived in a rural area and 56.1% had a less than primary school level of education. The infected subjects could have become infected through consumption of unhygienically prepared food or water contaminated with animal feces. Farmers may use infected animal feces as fertilizer (Wall *et al*, 2011). Ghadirian *et al* (1974) suggested the high prevalence of infection in some areas of Iran may due to close contact between animals and human. The infection rates in this study during the dry and rainy seasons were nearly equal. This is in contrast to the findings of Wall *et al* (2011) who found a higher prevalence during the rainy season. This could suggest differences in infections by season between endemic and non-endemic areas.

Wall *et al* (2011) reported a case of trichostrongyliasis with abdominal pain and bloating, followed by diarrhea and weight loss. In our study one case had symptoms of flatulence, bloating, and anorexia. Of the 41 cases reported here, 95.1% had underlying diseases. This is not surprising because Srinagarind Hospital is a tertiary care hospital serving patients from northeastern Thailand and the Lao PDR. *O. viverrini* and *S. stercoralis* were the two most common co-infecting parasites in present study. The trichostrongyliasis patients in this study came from parasite endemic areas.

The clinical characteristics of trichostrongyliasis only infected patients were investigated in this study because co-infection with other helminthes might confuse the clinical picture. Most patients with trichostrongyliasis only were asymptomatic, had normal appearing feces, had no occult blood in their stools and no eosinophilia. This is different from some previous studies (Boreham *et al*, 1995; Lattes *et al*, 2011) who found many symptoms, such as abdominal pain, flatulence, bloating, skin rash and diarrhea. With severe trichostrongyliasis, emaciation, dry skin and mild anemia may occur (Faust *et al*, 1970). These features were not seen in the present study possibly due to the light intensity of infection.

In conclusion, this hospital based study provides useful information for clinicians who are working in areas where trichostrongyliasis can occur, such as Thailand, the Lao PDR, communities located along the Mekong River and agricultural areas where risk factors are found.

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