ISSN (Print) 0023-4001
ISSN (Online) 1738-0006

Korean J Parasitol Vol. 49, No. 4: 405-408, December 2011
http://dx.doi.org/10.3347/kjp.2011.49.4.405

▣ CASE REPORT

The Fifth Outbreak of Trichinosis in Korea

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Abstract: Trichinosis is a food-borne zoonotic disease caused by the nematode, *Trichinella* spp., and had been reported several times in Korea. Recently, there was an additional outbreak, involving 5 patients, the findings from which are reported herein. On 30 November 2010, 8 persons ate sashimi of the meat of a wild boar. Then, 2-3 weeks later, they complained of myalgia and fever. Unfortunately, muscle biopsy was not performed, but ELISA was performed using their sera. Two people among 8 were positive for *Trichinella* on the 34th day post-infection (PI), and 3 patients who initially revealed negative ELISA were additionally proved to be positive for trichinosis on the 42nd day PI. Hence, the confirmed patients of trichinosis were 5 in total in the present outbreak. They were treated with albendazole and discharged uneventfully. This was the fifth outbreak of trichinosis in Korea.

Key words: *Trichinella*, trichinosis, wild boar, ELISA, outbreak

INTRODUCTION

Trichinosis is a food-borne zoonotic disease caused by *Trichinella* spp. [1]. The source of infection is mostly uncooked or poorly processed meat, whether pork or wild animal meat [2]. It has been a major public health problem worldwide, and human trichinosis has been reported in 55 (27.8%) of the world's 198 countries [3]. Among the 7 species of *Trichinella*, *T. spiralis* is the most prevalent etiologic agent of human trichinosis, and the isolate in the Korean case was proven to be *T. spiralis* [2,4]. It has been suggested that *T. spiralis* originated from Europe and subsequently spread anthropogenically to other continents, such as Africa and America [5].

There have been numerous outbreaks of trichinosis in Asia, particularly in China and Thailand [6]. From 1964 to 2003, in China, 247 people died from trichinosis, and in Thailand 97 died from 1962 to 2005 [7,8]. Recently, an outbreak from eating raw soft-shelled turtles (*Pelodiscus sinensis*) was also reported in Taiwan [9]. The first occurrence of trichinosis among humans in Korea was related to consumption of the meat of badgers, *Meles meles melanogenys* [10], and several outbreaks followed after then. This paper reports the fifth outbreak of human trichinosis from consumption of a wild boar (*Sus scrofa*).

CASES RECORD

In December 2010, 2 patients were admitted to the Department of Internal Medicine, Dankook University Hospital, due to complaints of generalized myalgia, headache, and facial edema. They were living in Cheonan-si, Chungcheongnam-do, and had dinner with their colleagues on 30 November, 2010. The main dishes were barbecue and sashimi, both from the meat of a wild boar. Among the participants of the dinner, 2 patients and 6 other people ate the sashimi. Two weeks after the dinner, the aforementioned symptoms developed in the former, and they visited Dankook University Hospital. After then, the rest of the people also complained of similar symptoms, such as myalgia, fever, and headache in 10 days, and were admitted to Dankook University Hospital. The incubation period of 8 patients was 16.3 days on average (Table 1).

The laboratory findings revealed elevation of the eosinophil count in all patients (14.2-41.2%), and elevation of C-reactive protein (CRP) in 6 patients. Leukocytosis was observed in only 2 patients, and muscle enzymes, creatine kinase (CK) and lactate dehydrogenase (LDH), increased in 2 patients. ELISA using the sera of the patients was performed in the Department

• Received 9 June 2011, revised 26 July 2011, accepted 16 August 2011.
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Table 1. Hospital records of 8 trichinosis patients

No.	Age/sex	Symptoms	Date of onset	WBC count (eosinophil; %)	Others
1	48/F	Generalized myalgia, headache, eyelid edema	12.15	9,430 (29.6)	CRP+
2	39/M	Myalgia, headache, fever, facial edema	12.15	4,760 (23.7)	CRP+ CK/LDH+/+
3	48/M	Myalgia, fever, chill	12.23	12,510 (41.2)	CRP+
4	62/M	Headache, myalgia	12.24	14,770 (24.6)	CRP+ CK/LDH+/+
5	37/M	Febrile sense	12.25	4,640 (24.4)	
6	56/M	Headache, sweating diarrhea (3 wk ago)	12.21	4,930 (26.0)	
7	34/M	Fever, myalgia	12.21	12,720 (39.0)	CRP+
8	37/M	Facial edema, myalgia, fever	12.21	5,130 (14.2)	CRP+

of Parasitology, Seoul National University College of Medicine on the 34th day post-infection (PI). The positive criterion of ELISA absorbance was 0.25, but only 2 serum samples were positive for *T. spiralis* antigen in the first ELISA. Sera collection was performed from 4 ELISA-negative patients 8 days later, and they were re-examined by ELISA for *Trichinella*. Among them, 3 samples were additionally proved to be positive (Table 2). Since the 2 ELISA-negative patients could not be followed-up, the confirmed cases of trichinosis were 5 in number. They were treated with albendazole for 2 weeks, and all the patients were discharged without any remaining clinical signs of trichinosis.

Table 2. ELISA results in sera of 8 patients

No.	Date of serum collection	Positive control	Negative control	Patient's ELISA titer[a]
1	2011. 1. 3	0.346	0.002	0.026
2	2011. 1. 3	0.346	0.002	0.097
	2011. 1. 11	0.376	0.005	0.253
3	2011. 1. 3	0.346	0.002	0.361
4	2011. 1. 3	0.346	0.002	0.255
5	2011. 1. 3	0.346	0.002	0.041
	2011. 1. 11	0.376	0.005	0.107
6	2011. 1. 3	0.346	0.002	0.068
7	2010. 12. 30	0.346	0.002	0.175
	2011. 1. 11	0.376	0.005	0.273
8	2011. 1. 4	0.346	0.002	0.240
	2011. 1. 11	0.376	0.005	0.267

[a]ELISA was done in the Department of Parasitology, Seoul National University College of Medicine. The positive criterion was 0.250. Underline means positive.

DISCUSSION

Including the first outbreak in 1997, there had been 4 reports of trichinosis outbreaks in Korea [10-13]. Since the first outbreak was separated into 2 reports, and the report on the outbreak in Inje-gun, Gangwon-do in 2001 has not yet been published, the present case is regarded the fifth outbreak in Korea (Table 3). Among the 34 Koreans diagnosed with trichinosis, only 27 could be located. Nineteen of them were males and 8 were females, with a mean age of 45.6 years. Their most common symptom was fever (27/27), followed by myalgia (25/27) and facial edema (18/27). Eosinophilia (>5%) was observed in all of them. The record of trichinosis mainly depends on consumption of the meat of domestic or wild animals, but the recognition of trichinosis by a clinician is important for detection of the outbreak. Thus, if a patient complains of myalgia and fever with eosinophilia, the doctor should consider the possibility of trichinosis. In our cases, muscle enzymes, such as CK and LDH were not always elevated, and leukocytosis was not an essential criterion of *Trichinella* infection (Table 1).

Trichinosis is definitively diagnosed by revealing the encyst-

Table 3. Outbreaks of trichinosis occurred in Korea

No.	Date	No. of patients	Infection source	Locality	Diagnosis [Reference No.]
1	December 1997	4	Badger	Geochang, Gyeongsangnam-do	Muscle biopsy, Ab test [10,11]
2	February 2001	5	Wild boar	Inje-gun, Gangwon-do	Muscle biopsy, ELISA
3	February 2002	4	Wild boar	Gangwon-do	Muscle biopsy, PCR [12]
4	March 2003	13	wild boar	Inje-gun, Gangwon-do	Muscle biopsy, ELISA [13]
5	November 2010	8	wild boar	Yanggu-gun, Gangwon-do	ELISA (+) in 5 patients

ed larva through a muscle biopsy [1], but such method could not be applied to each patient. Serologic tests may be helpful for the diagnosis, and ELISA using an excretory-secretory (ES) antigen is the most commonly used assay, with 99% sensitivity and 91-96% specificity [14]. In particular, ELISA has an advantage over digestion method in lightly infected animals [14], and it could be the useful diagnostic method in Korea, where trichinosis has not been rampant. A disadvantage of ELISA is occurrence of false-negative results during the early stages of infection [14]. In the first outbreak in Korea, the result of the antibody test was positive on the 34th day PI [10]. In our cases, the results of ELISA for the *Trichinella* antigen were positive only in 2 sera among 8 collected on the 34th day PI, and positivity was additionally recorded in 3 more sera out of 4 examined on the 42nd day. In the fifth patient, ELISA negative conversion was reported on the 42nd day PI (Table 1), whose complaint was only a febrile sensation without myalgia. It was suggested that the infection density of *Trichinella* larvae might have been low in that patient. Since the 2 negatives on the 32nd day PI could not be followed-up by ELISA, the confirmed patients of trichinosis were only 5 in the present outbreak.

Although the first outbreak was caused by eating of the raw badger meat, *M. meles melanogenys,* the rest was due to eating the wild boar meat, *S. scrofa* [10-13]. Because 4 of the outbreaks were concentrated in Gangwon-do, it is supposed that the life cycle of *T. spiralis* is maintained in Gangwon-do. Examinations of wild animals to determine the prevalence of *Trichinella* have been frequently performed in other countries. A national survey on 4,517 wild boars revealed 4% seropositive animals in Corsica, France, and 1.4% ELISA-positive wild boars in Germany and 8.7% in Switzerland [15,16]. A survey to estimate the prevalence of trichinosis in wild boars in Korea is thus urgently needed.

Domesticated animals could also be the source of human trichinosis. The outbreaks were caused by eating raw or undercooked pork in China, and the main sources of infection in Thailand have been pigs [7,8]. In China, the seroprevalence of swine trichinosis ranged from 0.01% to 30.0%, and the prevalence of *Trichinella* was from 0.06% to 5.6% in the pork sold in markets [7]. The prevalence of native *Trichinella* is 11.4% in red foxes in Otaru, Japan [17]. The surveillance of *Trichinella* infection in pig-breeding farms, however, revealed no positivity for infection in Korea [12]. Although their study [12] is the only one on domesticated animals in Korea, the infection rate of the pork with *Trichinella* is expected to be low, considering the small number of outbreaks. The risk of *Trichinella* infection should be publicized, however, since some Koreans enjoy eating raw wild animal meat.

In this report, the species of *Trichinella* could not be identified due to the unavailability of larvae. The *Trichinella* found in Asia and the Pacific Rim include both encapsulated (*T. spiralis*, *T. britovi*, and *T. native*) and non-capsulated species (*T. pseudospiralis, T. papuae*) [6]. In Japan, *T. britovi* was reported [6]. In Korea, only 1 species, *T. spiralis*, was identified [4,18]. Possible presence of other species in Korea should be determined in the near future.

ACKNOWLEGMENTS

This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2011-0009312). We are grateful to Hye-Sung Kim, Department of Parasitology and Tropical Medicine, Seoul National University College of Medicine, for performing ELISA.

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