INTRODUCTION

_Lophomonas blattarum_ is a protozoan that usually parasitizes in the intestinal tracts of termites and cockroaches. _Lophomonas_ belongs to the supergroup Excavata, first rank Parabasalia, and second rank Cristamonadida in protozoa [1]. It can cause infections in a variety of tissues and organs, including the maxillary sinus and other sinuses, lungs, reproductive system, and respiratory tract. This infection is difficult to differentiate from other common infections with similar symptoms. Here we reported a case of _L. blattarum_ infection confirmed by bronchoalveolar lavage fluid smear on the microscopic observations. The patient was a 21-year-old female college student. The previous case which occurred in Chongqing was 20 years ago. We briefly reviewed on this infection reported in the world during the recent 20 years. The epidemiological characteristics, possible diagnostic basis, and treatment of this disease is discussed in order to provide a better understanding of recognition, diagnosis, and treatment of _L. blattarum_ infection.

CASE DESCRIPTION

A 21-year-old female college student was admitted to the University-Town Hospital of Chongqing Medical University,
Table 1. Review of human infections with Lophomonas blattarum (1993-2013)

| Reported case no. | Sex/age of patients | No. of cases | Year | Country (region) | Reference |
|------------------|---------------------|--------------|------|------------------|-----------|
| 1                | F/35y               | 1            | 1993 | China (S)        | [8]       |
| 2                | M/38y, F/32y        | 2            | 1997 | China (S)        | [28]      |
| 3                | F/51y               | 1            | 1998 | China (S)        | [25]      |
| 4                | F/34y               | 1            | 1999 | China (S)        | [33]      |
| 5                | M/15y               | 1            | 2000 | China (S)        | [31]      |
| 6                | F/20y               | 1            | 2003 | China (S)        | [10]      |
| 7                | M/56y               | 1            | 2004 | China (S)        | [9]       |
| 8                | M/55y               | 1            | 2005 | China (N)        | [15]      |
| 9                | M/58y               | 1            | 2006 | China (S)        | [22]      |
| 10               | M/21y               | 1            | 2007 | Spain            | [5]       |
| 11               | M/39                | 1            | 2007 | China (N)        | [17]      |
| 12               | (19M+7F)/(19-95y)a  | 26           | 2007 | China (S)        | [23]      |
| 13               | F/34y               | 1            | 2007 | China (N)        | [18]      |
| 14               | M/65y, M/55y, F/53y | 3            | 2008 | China (S)        | [23]      |
| 15               | M/35y               | 1            | 2008 | China (N)        | [14]      |
| 16               | M/16y               | 1            | 2008 | China (S)        | [21]      |
| 17               | F/32y               | 1            | 2008 | China (N)        | [3]       |
| 18               | (11M+6F)/(19-65y)a  | 17           | 2009 | China (S)        | [24]      |
| 19               | NA                  | 1            | 2009 | China (S)        | [35]      |
| 20               | F/9d                | 1            | 2009 | China (S)        | [16]      |
| 21               | M/25y               | 1            | 2009 | China (S)        | [32]      |
| 22               | F/78y               | 1            | 2009 | China (S)        | [27]      |
| 23               | NA                  | 1            | 2010 | Spain            | [6]       |
| 24               | NA/(4m-15y)a        | 6            | 2010 | Peru             | [4]       |
| 25               | (14M+10F)/(29-84y)a | 24           | 2010 | China (N)        | [19]      |
| 26               | F/51y, M/73y        | 2            | 2010 | China (S)        | [34]      |
| 27               | M/41y               | 1            | 2010 | China (S)        | [36]      |
| 28               | F/54y               | 1            | 2010 | China (S)        | [20]      |
| 29               | M/21y               | 1            | 2011 | China (N)        | [37]      |
| 30               | (17M+15F)/(20-86y)a | 32           | 2011 | China (S)        | [39]      |
| 31               | M/41, M/55          | 2            | 2011 | China (S)        | [2]       |
| 32               | M/67y               | 1            | 2012 | China (S)        | [30]      |
| 33               | F/59y, M/77y        | 2            | 2012 | China (S)        | [13]      |
| 34               | F/47y, F/61y        | 2            | 2013 | China (S)        | [38]      |
| 35               | M/69y               | 1            | 2013 | China (S)        | [11]      |
| 36               | F/25y               | 1            | 2013 | China (N)        | [12]      |

aSex composition/Age range.
NA, not available; S, southern area of China, N, northern area of China.

Chongqing, China, on 21 June 2013, with chief complaints of cough and expectoration for 3 days accompanied with fever for 2 days without any past or family history. Three days ago, she caught a cold followed by expectorating white phlegm along with sore throat, and the body temperature was up to 39°C before 1 day ago. She was diagnosed as pneumonia on the chest X-ray in another hospital.

On 22 June 2013, physical examination of the patient showed both lung breath sounds rough, the bilateral lower lung auscultation with rales or rhonchi and the other vital signs included blood pressure 106/72 mmHg, pulse rate 115 beats/min, respiratory rate 20 breaths/min, and body temperature 36.9°C. The clinical laboratory tests for blood, urine, feces, and hepatic and renal functions were within normal limits. However, the C-reactive protein (CRP) was 32.7 mg/L and the erythrocyte sedimentation rate (ESR) was 22 mm/hr. Chest computed tomography (CT) scan showed right pleural effusions accompanied with pleural adhesions, enlarged mediastinal lymph nodes and the left inferior lobar inflammation. Meanwhile, she was treated with cefoxitin for anti-infection and enhancement of immunity. One day after admission, her body temperature and the pulse rate were within normal limits. However, both the rough lung breath sounds and the bilateral lower lung auscultation with rales or rhonchi were continued. Acid-fast bacilli (AFB) were negative in the sputum smear, and electronic bronchoscopy was done in the left lower lobe basal segment.

The BAL fluid was collected by bronchofiberscope, and the upper frothy sputum was spread on 4 glass slides for Wright-Giemsa stain. The live protozoan, L. blattarum, was found on light microscopy of the BAL smear. It was about 20-30 µm in size, with a round or oval-shaped body and 30-40 flagella on one end. L. blattarum can swim fast by waving its flagella constantly. After the Wright-Giemsa staining, it changed to pear-shaped, with mauve colored cytoplasm. The flagellum length was from 8 to 18 µm, arranged in bundles on one end (Fig. 1).

**DISCUSSION**

After reviewing the literature [2,3,8-39], we found 136 cases of previous reports of L. blattarum infections that had occurred in 11 provinces and 2 municipalities in China since 1993. Among the patients, 80 cases were male and 55 cases were female, besides 1 with unknown gender, with ages ranging from 9-days to 95 years-old. It was shown that the infection had no significant differences by gender and age. The occurrence of patients from the southern China area was 76.5% and the others came from the northern area. The southern China refers to Hunan, Anhui, Zhejiang, Jiangsu, Guangdong, Fujian province, and Chongqing municipality. The northern China refers to Shaanxi, Liaoning, Shandong, Hebei, Xinjiang province, and Tianjin municipality. The weather of southern area is warmer and more humid.

As a part of the reported cases was identified without giving the pest species only to families, it could be called ‘hypermastigote’ in many databases (now called Cristamonadida [1]).
We detected the patients infected with 'hypermastigote' or *L. blattarum* as the search keyword in VIP-database, CNKI, Wanfang-database (the 3 major databases in China), PubMed database, Embase database and the Web of Science database retrieved all the reports in recent 20 years. After rechecking and screening, 136 cases were determined. Their clinical features were listed below (Table 2).

The diagnostic clues of *L. blattarum* infection are as follows: First, patients have clinical symptoms of an infection without the effect of anti-infection treatment with a marked peripheral blood eosinophilia. Second, patients have underlying diseases and treated with immunosuppressants for a long time or with the pulmonary infection after surgery. Third, the X-ray and CT imaging features of the patients show ground-glass opacity, patchy consolidation, and patchy or streaky shadows distributed in bilateral lungs. Forth, the detection of *L. blattarum* can be done in sputum smears, bronchoscopy biopsy smears, or BAL. All the reported cases in China confirmed that the treatment of the infection depends on metronidazole and tinidazole.

*L. blattarum* was proved to parasitize in the colon of cockroaches [40]. Although *L. blattarum* usually parasitizes in intestinal tracts of termites and cockroaches, it could be discharged being accompanied with the secretion and excrement of the host's digestive tract. The cysts of this protozoa are spread by contaminated food and clothing. Therefore, someone could be infected easily by breathing the dust containing *L. blattarum*. To prevent *L. blattarum* infection, it is needed to control the source of infection, that is, termites and cockroaches. In fact, human infections with *L. blattarum* are relatively rare. In the past 2 decades, 136 cases of *L. blattarum* infection, including 2 disputable cases have been reported in China [41]. The patients reported from southern cities accounted for three-quarters. It is most likely because cockroaches and termites are the hosts of *L. blattarum*, this protozoan can breed easily in the

![Fig. 1. Lophomonas blattarum detected from BAL fluid of the patients by microscopic observations: Direct smear (A, B, ×400) and Wright-Giemsa stain (C, D, ×1,000).](image)
humid environment.

So far, except for the 136 cases being concentrated in China, *L. blattarum* infection was also reported in humans in Peru in 2010 [4] and Spain in 2007 and 2010 [5, 6]. There was 1 case of *L. blattarum* isolated from a houbara bustard that was a clinically normal bird in the United Arab Emirates in 1999 [7]. After all, 95 of 136 clinical cases which account for around two-thirds, occurred within the recent 5 years. The clinical manifestations and signs of *L. blattarum* infection are similar to the other etiologic pneumonia and bronchitis. It is difficult to diagnose correctly.

Two points are worthy of special mentioning: 1) ineffectiveness of antibiotics. Among the 136 patients diagnosed with *L. blattarum* infections, 46 patients were treated with antibiotics for anti-infection and anti-inflammatory before using metronidazole (1 patient took antibiotics for almost 3 months without effects [3]), but all invalid. 2) The influence of the underlying disease was significant. For example, 68 of 136 cases had underlying diseases (it included 3 types of diseases, 1 was the basic metabolic disorders, the other 2 were the weakened immune system and severe chronic wasting disease), mainly with severe chronic obstructive pulmonary disease (COPD) and organ transplantation which accounted for 29.4% and 30.9%, respectively. Above all, it is strongly needed to have knowledge on *L. blattarum* infection before giving diagnosis and treatment of this protozoan infection.

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**CONFLICT OF INTEREST**

We have no conflict of interest related to this study.

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