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Retrospect and Prospect of *Lophomonas blattarum* Infections and *Lophomoniasis* Reported in China

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Abstract

***Lophomonas blattarum* is a recently discovered parasitic protozoan that may infect humans and cause serious respiratory symptoms which are deadly. This review has summarized recent findings on the etiological characteristics, routes of transmission, clinical symptoms, laboratory diagnosis, and treatment of *L. blattarum* infection and diseases in China.**

Keywords

***Lophomonas blattarum*, Infection, Clinical Symptoms, China**

Subject Areas: **Infectious Diseases, Respiratory Medicine**

1. Introduction

These parasites often lead patients to death. In addition to the *Toxoplasma gondii*, *Pneumocystis* and *Cryptosporidium*, in recent years, it has been found that a human parasitic pathogen or *Lophomonas blattarum* would infect humans. The worm is parasitic in the gastrointestinal tract of termites and oriental cockroach (*Blatta orientalis*). In China, it is occasionally parasitic in the human body. The first case of infection was reported in China in 1992 [1]-[3]; 15 cases of infections were reported until 2005 countrywide [1]-[11]. From 2006 to date, 82 cases of infections have been reported [12]-[42]. In 98 patients with respiratory tract infection in Changchun City hospital from 2004 January to 2006 December, there were 30 cases of infections with *lophomoniasis* in General Hospital of PLA in Guangzhou Military Area; from 2006 October 14 to February 2007 in outpatients and inpatients there were 26 patients diagnosed with *Lophomonas blattarum* infections [17], which illustrated

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that there is a growing trend in *lophomoniasis*, which should cause enough attention. This article has summarized and prospected the biological characteristics, clinical manifestations, laboratory diagnosis, clinical treatment and epidemic characteristics, pathogenic conditions and other aspects of *Lophomonas blattarum* infections and *lophomoniasis* in human body.

2. Morphological and Pathogenic Characteristics

1) *Lophomonas blattarum* belongs to the phylum Protista, Zoomastigophorea, Hypermastigita, Lophomonadina, Lophomonadidae, l *Lophomonas*, *Lophomonas blattarum*. As the worms were found in a short time, and they are the rare human parasites, some case reports are without identification of many data, so the worm was called Hypermastigote. In normal saline smear, live worm body is circular, oval, translucent, renal formed, pear or squid fish shape. Body size is different, Hypermastigote body size is disparity, the small is 7 - 10 um, the big 30 - 40 um. Flagella are before half of the body. Flagellar clusters are at one end of a plurality, flagellar were kept fast swing, making the body to rotate forward swimming along its longitudinal axis. Under oil microscopic observation, the smear specimens using Wright (or Giemsa's) staining or compound staining, the visible body demonstrated oval or pear-shaped, cytoplasm was purple and purple brown, there is vesicular nuclei which is located in the front of body. The outer side of one end of worm having flagella, dark purple, arranged in a ring. The flagellum is more, but is not easy to count for the exact number, about 40 - 80 in length, 5 - 18 um in width. If the worm is fixed and stained properly, there can be reduced deformation of the worm which increased the difficulty of identification. The nucleus and the flagellum has been separated, and the cell membrane has not been separated from the body [3] [14] [17] [22] [26] [27]. Life history process of *Lophomonas* is not very clear, it has two division and reproduction, and form cysts.

2) Pathogenic transmission pathways: *Lophomonas blattarum* is gut parasite of cockroach and the termite. Along with gastrointestinal secretions of host, excretions from cysts with contamination of food, clothing, supplies, communication, the parasite will enter the respiratory tract of a human body through the pharynx, or by inhalation of dust containing Hypermastigote [3]. According to a survey from a middle class family in New York of the United States of America, collection of the German cockroach and *Lophomonas* infection rate was 47.62% [31]. Most areas of China are suitable for breeding of cockroaches and termites, especially in the southern regions which are warm and wet all year round, and benefited for growth and reproduction of cockroaches and termites which supports distribution of *Lophomonas blattarum* infection [2] [21] [22]. Liu Zhenjun [16] reported an adult female *Lophomonas* infection, who firstly cleaned the cockroaches contaminated water at the bleeding bottom, and in the cleaning process she had not weared a mask for protection. Although patient was shower dressed after cleaning, but it was still considered that the patient inhaled contained *Lophomonas* from cockroach feces. So far it is not common about infectious reports within the peoples. *Lophomoniasis* of humans may be from inhalation of pollutants induced by cockroaches, such as being inhaled contaminated dusts from cockroaches and termites and became infected. When the human body's resistances to pathogens have dropped, the *Lophomonas* infections would produce bronchial and pulmonary lesions, the pathogen are growing massly, inducing hypersensitivity, and airway inflammation of human beings.

3) Susceptible population for *lophomoniasis*: all reported cases are sporadic, the hospitalized patients those who are for the elderly, with long course of disease, acute onset, patients and bacterial infections. The respiratory tract, pulmonary bronchial infections accounted for more than 90%, others are from the pharynx, maxillary sinus and urine seized by *Lophomonas* infection reports. Population with long-term use of antibiotics leading to an imbalance of normal flora in the human body are also susceptible to the *lophomoniasis* which are important factors. Nanjing Military Institute and firstly affiliated People's hospital of Shanghai Jiao Tong University l had reported 5 patients with *Lophomonas* infections after kidney transplantation which were prompting pulmonary infections with severe restriction of immune functions, 5 patients had obviously immunocompromised, manifested as peripheral blood lymphocyte count (CD4+/CD8+) decreased [13] [30].

3. Parasitic Sites, Pathogenic Mechanisms and Clinical Manifestations

1) Parasitic sites: *Lophomonas blattarum* infection and *lophomoniasis* may occur in human's maxillary sinus, bronchials, sputum, urine and lung and pulmonary cysts in the maxillary sinus mucosa of chronic inflammation, with polypoid changes [6]-[9] [33].

2) Pathogenic mechanisms: going through the literatures, *Lophomonas blattarum* parasite entered the bronchial lumen, adhesing in bronchial mucosa. Worm and its secretions could induce allergic reaction of bronchial mucosa, and eosinophilia, IgE and IgA and were increased. This parasite may also secrete special materials which makes its body tightly adhered on the bronchial mucosa. So that it is not easy for patients to be coughed up, even in cleaning under the bronchoscope. I type allergic reaction induced by the parasite has individual differences in bronchial asthma. *Lophomonas blattarum* in intraluminal multiple rapidly, grow unitingly, which can be formed in endobronchial yellow-white lump, up to 1 cm in diameter which can result in partially complete obstruction, and easily complicate with bacterial infection, and further lead to pulmonary abscess or bronchial dilatation [24].

3) Clinical manifestations: the clinical manifestations of *lophomoniasis* demonstrated fever, coughing, expectoration, chest painful, shortness of breath and other symptoms. The chest X ray showed pulmonary double limited inflammatory infiltrations. But as the disease progresses or with other pathogenic infections, patients may present expectoration of phlegm, usually white or yellow purulent sputum and bloody sputum. Some patients appeared intractable cough, a small amount of expectoration and fever, the temperature was as high as 38˚C - 39˚C. Also, patients had chest pain, shortness of breath, chest tightness and other symptoms of palpitation accompanied by malaise, dyspnea or asthma. In respiratory tract, there sounds coarse auscultation, and a large number of moist rales or fine rales, wheezing. Pleural effusions of local percussion was voiced [14] [17] [27]. In addition, the researchers have reported patients with pulmonary infections of *lophomoniasis* in renal and liver transplantations [40] [41].

4. Clinical Diagnosis

1) Imaging examination: depending on the different extent of the lesions, examination of the lungs with X ray and CT showed bronchial shadowy thickening, and alveolar exudates, increased lung markings, which can be scattered in different patchy shadow, edge blur, hilar density increased, manifestations of pneumonia or pulmonary interstitial inflammatory have changed. Lung abscess, pleural effusion, central bronchiectasis with infection and bronchitis with right lower pneumonia have been also demonstrated. In addition, chest showed that t patchy, nodular, cord-like infiltrates in lung on the middle and lower field [18] [19] [21].

2) Branch bronchoscopy examination: visible mouth mucosa is narrow, rough. Remaining section of bronchial of two lungs have different degree of stenosis, mucosal hyperemia edema. In the intraluminal visible viscous secretions and intraluminal bronchial materials, the common living *Lophomonas blattarum* parasites have been observed under microscope after the smear, and adjacent mucosa has massive eosinophilic infiltration [15] [23] [25] [27] [28].

3) Bronchoscopy examination: microscopically the bronchial orifice was narrow, congestional and edema, orifices are yellowish-white necrosis-like complete obstruction. In the reported *lophomoniasis* cases, bronchial pulmonary infections were diagnosed [36] [37].

4) Routine blood examination: the peripheral white blood cell count of the majority of patients is elevated, and peripheral blood eosinophilia is increased about 1/3 cases of patients. Due to immunocompromised activity of renal transplant patients infected with *Lophomonas blattarum*, the peripheral blood lymphocyte count was decreased [13] [14] [24] [27].

5) Pathogenic examination: we must find the parasite with confirmation of infection of *Lophomonas blattarum*. Examination of the specimens included examinations of sputum, bronchoscopy retrieved tissues and secretions, bronchoalveolar lavage fluids. There are also reports parasitized in pharyngeal secretions, urine and maxillary sinus operation [3] [7] [11]. Pathogenic examination was mainly undertaken by physiological saline wet smear method (with slide) under the microscope to observe the activities of worms. *Lophomonas blattarum* is circular, oval or pear-shaped, circular capsid and nuclear shaped, in one end of the body are flagella, which were less than the body diameter in length, flagella showed rhythmic swinging and rolling movement. With the dyeing (with Wright's stain or Giemsa's solution), visible worms were oval, nuclear showed purplish black, flagella are deeply purplish red [27].

5. Laboratory Diagnosis

According to the diagnosis of reported cases, the following aspects would be as diagnostic clues of *Lophomonas blattarum* infections: 1) patients with pneumonia, pulmonary abscess, is ineffective with regular anti-infection

treatment; 2) patients with the original bronchial dilatation demonstrated unprovoked appearanced, sputum volume increased, bloody sputum or hemoptysis sputum amounted, and had stench taste, pale yellow, volume, viscosity, and symptomatic treatment is ineffective; 3) patients with chronic cough, asthma, in poor conventional therapy, especially peripheral blood eosinophil level increased; 4) elderly patients with unexplained pulmonary infection after antibiotic treatment was ineffective; 5) patients with postoperative pulmonary infections in poor conventional therapy; 6) patients with pulmonary infections after long-term application of immunosuppressant, [17] [21] [30]; 7) in the above patients who should be repeated examination of sputum, or as soon as possible bronchoscopy and bronchoalveolar lavage fluids, confirmed of parasite infections.

6. Clinical Treatment [10] [15] [16] [21] [25] [28] [31]

Metronidazole and tinidazole were commonly used to treat *lophomoniasis*.

1) Metronidazole has strong effect on flagellar trichomond, and is the first drug of choice on treatment of Trichomonas vaginalis infection. This drug can also be used for ameba dysentery and ameba liver abscess. Treatment of doses against *lophomoniasis* and its infection was commonly 400 - 800 mg, 3 times/day with oral course for 5 - 7 days for each patient. Usage of 0.5% metronidazole Injection by intravenous infusion of 100 ml, 2 times/day for 7 - 10 days for one course. After treatment, the patients' cough and asthma symptoms disappeared, sputum color got white, and significantly reduced the amount of sputum, routine examination did not find any *Lophomonas* [21] [30], it was hypothesized that metronidazole could inhibit oxidation reaction of protozoa, but the exact pharmacological mechanism is still not clear.

2) Tinidazole is an antiprotozoal drug which can be against anaerobic bacteria infection. Oral absorption is complete, rapid onset, 2 h up to the highest concentration, then decreased slowly, elimination half life period is 12 h - 24 h. Treatment of *Lophomonas* infection is usage of 0.4 g intravenous injection, 1 times/day for 3 - 5 d. Metronidazole and tinidazole in safety are better, treatment doses with patients have no toxicity reaction. But in the long course of treatment, larger doses can occur when a mild adverse reactions such as nausea, vomiting, anorexia, metallic taste, diarrhea and other gastrointestinal reaction; headache, numbness of limbs and nervous system symptoms, occasional skin allergy reaction. The above can be recovered after stopping. In bronchoalveolar lavage fluids of small amounts only were found dead body of Hypermastigot [11] [21]. Women with pregnancy within 3 months and breastfeeding, diseases of the central nervous system and blood disease were not used the drug treatment. Medication and during 1 weeks after drug withdrawal should be temperance. Withdrawal of immunosuppressive agents and drug treatment can alleviate quickly the condition.

7. Prospect

Lophomonas blattarum is a kind of animal parasitic protozoa, which are often parasitic in the gut of termites and cockroaches. Reviewing foreign literatures, no human infections are reported abroad. Further studies should be undertaken on *Lophomoniasis* in pandemic possibility and in response to the spread of the disease mechanisms, pathogenesis, molecular biology diagnosis and drug use.

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