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Case Report

Hymenolepis diminuta Infection in a Rural Child from North of Iran

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Abstract

We report a case of *Hymenolepis diminuta* infection in a two years old boy living in Guilan Province, northern Iran diagnosed in 2019. The patient was complained of anorexia, weight loss, weakness and disturbed sleep. Stool examination revealed numerous eggs of *H. diminuta.* After treatment with a single dose of oral praziquantel, the patient recovered without evidence of the egg shedding in follow-up stool samples. Moreover, we performed detailed phylogenetic analysis of the *H. diminuta* comparing with other isolates deposited in GenBank database based on *Cox1* gene. Based on BLAST analysis of *Cox1* gene our sequence showed 97.4-99.2% similarity with those of *H. diminuta* available in GenBank. The present study recommends the importance of reporting the infection cases, in order to improve knowledge on epidemiology and control of the neglected disease.

Introduction

Hymenolepis diminuta is a common tapeworm of rodents, but human infections were reported rarely in regions with poor sanitation (1). Rodents considered as a principal definitive host and humans can infect by accidental ingestion of insects containing the cysticercoid larvae. Different species of arthropods, including rat and mouse fleas, flour beetles, cockroaches and caterpillars have been identified as intermediate hosts (2, 3).

The adult worms live in the small intestine of human host, with the scolex attached to the mucosa (4). Most infections are usually asymptomatic and the worm burden is determinant of symptoms. Some patients may present with abdominal pain, diarrhea, anorexia, nausea, headache and dizziness; they are most likely to be seen in infected cases with a heavy infection (5, 6). Adult worms are appeared in the small intestine, and eggs passes in the stool, therefore diagnosis is made by identification of the eggs in the stool samples (4, 6). In the worldwide, the majority of human *H. diminuta* cases have been reported from children living in rural areas (7).

Human *H. diminuta* infection has been reported from 0.001% to 5.5% in different countries (6, 8). To date, several human cases have been reported from the northern, northeastern, southern and central parts of Iran (9-11).

Here, we present a case of *H. diminuta* infection in a child from Guilan province, northern Iran. Moreover, we performed detailed phylogenetic analysis of the *H. diminuta* comparing with other isolates deposited in GenBank database based on *Cox1* gene.

Case presentation

In 2019, infection with *H. diminuta* was detected in a two-year-old boy during epidemiological investigation on prevalence of intestinal parasites in the rural areas of Talesh district of Guilan Province, northern Iran. The patient complained of anorexia, weight loss, weakness and disturbed sleep. According to her mother declaration, the child had accustomed to swallow fruits and rubbish collected from the yard. Stool examination revealed numerous eggs of *H. diminuta* (Fig. 1). The patient successfully treated with praziquantel (4.5 tablet 50 mg) in a single dose and turned asymptomatic. The patient was followed up two months after treatment and no eggs were detected using parasitological examinations.

Ethics approval

The study was approved by Ethics Committee of Guilan University of Medical Sciences, Iran (IR.GUMS.REC.1397.174).

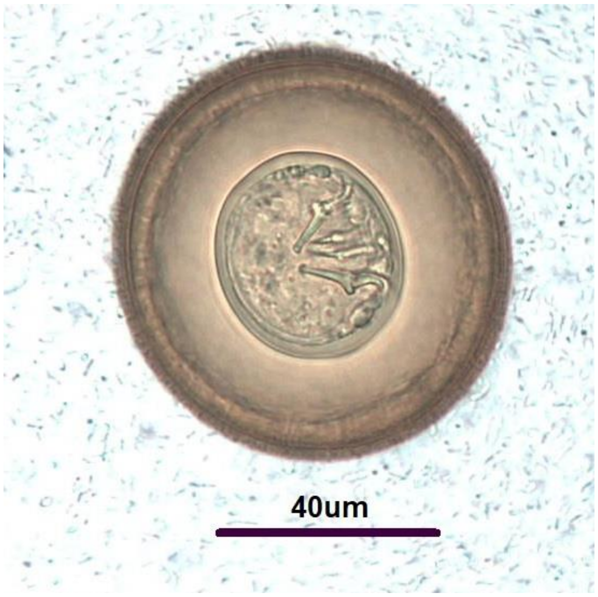

Fig. 1: Light microscope view of *Hymenolepis diminuta* egg found in the patient’s stool. The egg contains six central hooklets but no polar filaments

Molecular analysis

DNA was extracted from eggs collected from the fecal sample using a commercial kit (High Pure PCR Template Preparation Kit; Roche, Mannheim, Germany) according to the manufacturer's instructions. An approximately 445-bp fragment of the cytochrome c oxidase subunit 1 region (Cox1) was amplified as previously described (12). The PCR amplicon was submitted to Bioneer Company (Korea) and sequenced in both directions. Next, the sequence result was edited using Chromas software (version 2.6) and compared with reference sequences using the BLAST software available at http://www.ncbi.nlm.nih.gov/. The phylogenetic tree was constructed using Tamura-Nei model of the maximum likelihood method by MEGA 6. Branch support was considered using 1000 replications for determining the reliability of the tree. The sequence of *Cox1* gene was deposited in GenBank database (Accession Number: MK614218). BLAST analysis indicated that our *H. diminuta* isolate had 99.2% homology with *Rattus rattus* isolate from South Africa (KY462777). This sequence also showed 98.6% similarity with *H. diminuta* from *Rattus rattus* in Spain (JN258045), human in Poland (MH472982) and red flour beetle in USA (KC990401). Intra-species variation of our isolate with those from other *H. diminuta* sequences deposited in GenBank database amounted to 0.8 to 2.6%. The phylogenetic analysis showed the *H. diminuta* sequence obtained from the current study was placed with other *H. diminuta* isolates from different host and countries with high bootstrap support (Fig. 2).

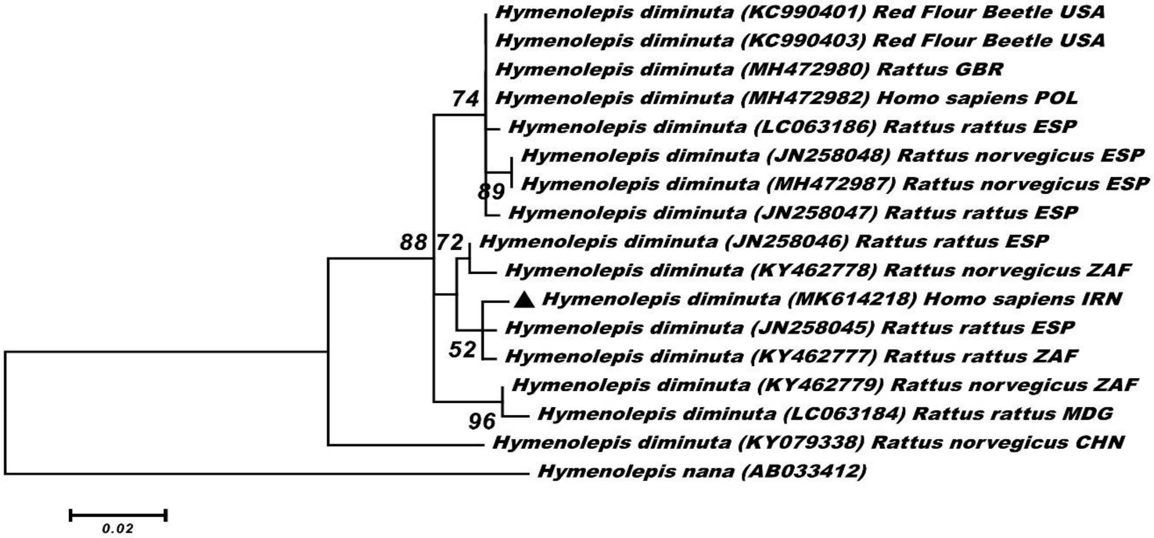

Fig. 2: Phylogenetic tree of isolate of the *Hymenolepis diminuta* obtained in this study (▲) and other isolates of *H. diminuta* as retrieved from GenBank based on the partial *Cox1* gene. The tree was constructed based on the maximum likelihood test and the Tamura 3-parameter model in MEGA6. *Hymenolepis nana* sequence was used as the out group. Bootstrap values lower than 50 were omitted

Discussion

Human cases of *H. diminuta* have been reported from about 80 counties around the world and these have mainly involved children. The majority of the cases were reported in the Americas, Southeast Asia, and the Eastern Mediterranean regions (3-5). The highest prevalence of the infection was reported from some rural localities of Pakistan (13) Ethiopia (14) and Bangladesh (15)

Human cases of *H. diminuta* are extremely rare in Iran and based on our knowledge, only seven cases have been reported until 2008 in some regions including Mashhad, Minab and Tehran, and most of them affected children (10, 11, 16). Moreover, the last case was reported in 2017, a 15-month-old boy from a rural area of Fouman region located in Guilan province, northern part of Iran (9).

The eating habits of insects in some areas such as Southeast of Asia can play an important role in transmission of the worm (17). However, consumption of insects is not eating habit of Iranian people, thus patients are only infected by accidental ingestion. Concerning our case, the child lived in a rural area and mostly played in the house yard having some fruit trees. This patient may have become infected during play via accidental ingestion of arthropods containing the cysticercoid larvae of *H. diminuta* that attached to fallen fruits and rubbish. According to the information obtained from the patient's parents, mice had been frequently observed in their courtyard. Although human cases of *H. diminuta* are often asymptomatic, some infected patients may be suffered from abdominal discomfort, diarrhea, nausea, anorexia, weight loss, irritability and cutaneous itching (6). The most clinical symptoms in our case were similar to those in the previous reports (5, 9). The patient's parents complained from his disputed sleeping which did not reported in other cases yet. This case was successfully treated with praziquantel, which is considered the drug of choice for the infection.

In present study, our isolate of *H. diminuta* was compared with the other isolates originating from different hosts and countries across the world based on *Cox1* gene. BLAST analysis of *Cox1* gene showed our sequence had 97.4-99.2% similarity with those of *H. diminuta* available in GenBank. It had the largest similarity (99.2%) with that from *Rattus rattus* from South Africa (KY462777). The phylogenetic analysis illustrated our sequence is grouped with *H. diminuta* isolates in *R. rattus* from Spain (JN258045 and JN258046) and South Africa (KY462777) and also in *Rattus norvegicus* (KY462778) from South Africa which indicates zoonotic potential of this parasite.

Conclusion

Human cases of *H. diminuta* are zoonotic infection that sporadically reported in Iran. The diagnosis of the infection is usually detected accidentally during a field study. Providing more genetic data from specimens of different countries and hosts would be useful to achieve precise understanding of its phylogenetic relationships.

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Conflict of interest

The authors declare that they have no competing interest.

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