Tropical Biomedicine 29(2): 224–230 (2012)

A case report of *Hymenolepis diminuta* infection in a Malaysian child

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Received 6 December 2012; received in revised form 14 February 2012; accepted 16 February 2012

Abstract. We report a case of *Hymenolepis diminuta* infection in a 2-year-old Malaysian child. This case was initially reported as 'normal' after the examination of proglottids shed from the anus of the child at a private laboratory on two occasions. The putative proglottids shed was then referred to the Parasite Southeast Asia Diagnostic (Para:SEAD) Laboratory, Department of Parasitology, Faculty of Medicine, University of Malaya for further examination. Microscopic examination confirmed that the child was infected with *H. diminuta* based on the characteristic eggs found in the proglottids. She was treated with a single dose praziquantel (20 mg/kg of body weight) and recovered well.

INTRODUCTION

Hymenolepis diminuta also known as rats and mice tapeworm is rarely found in humans and is acquired by accidentally ingesting infected intermediate host, i.e., arthropods containing the cysticercoid larvae. To date, more than 20 different species of arthropods including beetles, fleas, caterpillars and other insects have been identified as intermediate hosts for the development of the cysticercoid larvae (Andreassen *et al*., 1999; de Carneri, 2004). The most important are flour moths and flour beetles. *Hymenolepis diminuta* is commonly found in areas where large amounts of rat's favourite food such as grain and other dry food product are stored. Inside the arthropod, the hexacanth embryo will emerge from the egg and develop into a metacestode stage called cysticercoid. Once the arthropod containing the infective stage (cysticercoid) is ingested by the definitive host, i.e., rat and human, it will grow into the adult form in the small intestine and its eggs will be passed out in the stool of the host (Andreassen *et al*., 1999; de Carneri, 2004).

The size of adult worm is usually 20 to 50 cm in length and approximately 4 mm in width. The scolex bears four suckers and a small rostellum without hooks. Diagnosis is based on the characteristic eggs in the stool. Eggs are approximately 70 µm in diameter, slightly ovoid and brown with relatively thick shell. Sometimes, fine concentric striations may be observed in the outer membrane shell. The inner membrane is thin containing six central hooklets but no polar filaments. The absence of polar filaments readily differentiates this species from *Hymenolepis nana*.

H. diminuta infection in humans is rare, typically occurring in isolated cases such as case reports describing a single affected individual (Levi *et al*., 1987; Varghese *et al*., 1998). Few cases have been reported especially in children with the prevalence rates ranging between 0.001% and 5.5% (McMillan *et al*., 1971; Naquira *et al*., 1973; Panpiglione *et al*., 1987; Lo *et al*., 1989;

Mercado & Arias, 1995; Tena *et al*., 1998). Most infection is often asymptomatic, but occasionally patients may present with itching and mild gastrointestinal complaints such as abdominal pain, irritability and diarrhoea. As for treatment, praziquantel is the drug of choice.

In Malaysia, there have been only two documented cases of *H. diminuta* in human (Sinniah, 1978; Kan *et al*., 1981). Compared to other nearby Southeast Asian countries, there are more documented cases, i.e., at least 10 cases, in Thailand (Wiwanitkit, 2004). Cases have also been recorded in Singapore (Paul & Zaman, 1969) and Indonesia (Stafford *et al*., 1980). No cases have been recorded in Cambodia, Myanmar, Laos PDR, the Philippines and Brunei. As for other parts of the world, few cases have been reported in Italy (Marangi *et al*., 2003; Patamia *et al*., 2010), Spain (Buen, 1914; Guevara & Dominguez, 1955; Vasallo & Gonzales, 1979; Velasco *et al*., 1980), India (Watwe & Dardi, 2008) and Jamaica (Cohen, 1989) and all of them involved children.

CASE REPORT

On 1st June 2011, a 2-year-old Malay girl living in a semi-rural area of Selangor, Malaysia was seen for the first time at a private polyclinic for abdominal discomfort and itchiness over the abdomen especially at night. She has been experiencing these symptoms for the last 3 months. There was no history of fits, anuresis, vomiting, passing of worm or fever. The main complaint was that the mother observed the intermittent passing of a "small white paste like structure" from the anal region for the last 3 months which never resolved with deworming medication. The child is the youngest of three siblings. Other family members and surrounding neighbours were healthy, showing no signs of similar illness.

The specimen passed out by the child was brought along during the visit and the attending physician sent it to a private laboratory on 2nd June 2011 and the result was reported as "normal". The child was brought back to the same polyclinic for her second visit on 14th July 2011 for the same complaints and again another specimen was sent to the same private laboratory and the result came back as "normal". Before the two visits to the polyclinic, the patient had visited two other general practitioner clinics whereby no laboratory investigation was done nor was deworming medication given.

On her third visit (10/8/2011) to the same polyclinic, a whitish specimen which the mother retrieved from the faeces of the child was sent to the Parasite Southeast Asia Diagnostic (Para:SEAD) Laboratory, Department of Parasitology, Faculty of Medicine, University of Malaya for confirmation. When the specimen, which looked like putative proglottids (Figure 1) reached the laboratory, a section of it was cut into small pieces. A fragment was placed in between a microscope slide and a cover slip, and it was firmly pressed and observed under the microscope.

Microscopic examination demonstrated numerous spherical eggs measuring approximately 76 µm in diameter. The egg had thick-shell with striated outer membrane and thin inner membrane containing six hooklets which is distinctive of tapeworm egg with absence of polar filaments (Figure 2). Although the eggs of *H. diminuta* are similar to *H. nana*, they can be easily differentiated as *H. nana* eggs are smaller (40-60 µm x 30-50 µm) and have two evident polar thickenings, from each of which arise four to eight polar filaments. Based on the bigger egg size and absence of polar filaments, they were identified as *H. diminuta* eggs. Following the diagnosis, the infected child was prescribed with a single dose praziquantel (20 mg/kg of body weight) and a stool examination carried out 2 weeks after treatment was negative for *H. diminuta* eggs and at the same time, her symptoms subsided.

DISCUSSION

Hymenolepis diminuta (rat tapeworm) has a ubiquitous distribution throughout the world, however it is rarely found in human. The natural reservoirs and definitive host of

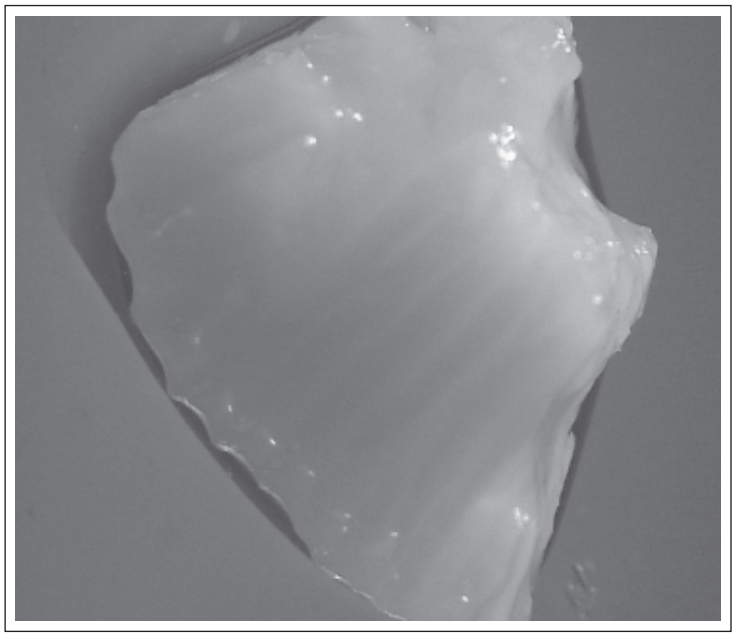

Figure 1. Putative proglottids of *H. diminuta* (approximately 0.1 to 0.2 cm in length and 0.8 cm in width) which was intermittently passed out from the patient's anus. Image taken at 10X magnification

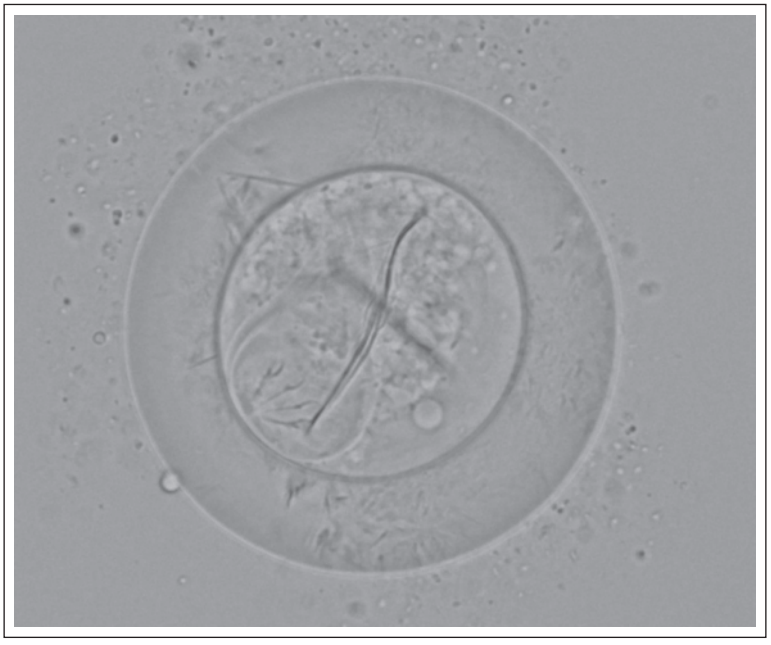

Figure 2. Egg of *H. diminuta* (approximately 76 µm in diameter) in an unstained wet mount from putative proglottid. The egg has thick-shell with striated outer membrane and thin inner membrane containing six hooklets which is distinctive of tapeworm egg with absence of polar filaments. Image taken at 400X magnification

H. diminuta are usually rats and other rodents. Unlike *H. nana*, *H. diminuta* requires an intermediate host to complete its life cycle. Various types of arthropods such as fleas (e.g., larval flea), beetles (e.g., flour beetle, grain beetle), flour moths, meal worms, cockroaches and caterpillars may act as obligatory intermediate hosts after ingesting *H. diminuta* eggs emitted in the rodent's faeces and develop into cysticercoid larvae in their body cavities. As the definitive host (rodent) eats an infected arthropod, cysticercoid present in the body cavity is introduced into the bowel of the rodent and later develops into the adult worm in about 18 to 20 days. The eggs produced are then passed out in the stool (de Carneri, 2004). It has also been found that *H. diminuta* eggs can also be dispersed in the natural environment by beetle-beetle transmission via its faeces (Pappas & Barley, 1999).

Although *H. diminuta* infection in human is rare, occasionally isolated cases have been reported (Levi *et al.*, 1987; Varghese *et al.*, 1998). Granted that humans can only accidentally enter into the life cycle of *H. diminuta* as definitive hosts when they ingest infected arthropods containing the cysticercoid larvae (de Carneri, 2004), most of the *H. diminuta* infections in humans are case reports describing a single affected individual. Currently, only a few hundred cases have been reported globally especially among children who are more likely to accidentally ingest the helminth larvae via infected arthropods (Cohen, 1989). However prevalence studies of different populations revealed rates of between 0.001% and 5.5% (McMillan *et al.*, 1971; Naquira *et al.*, 1973; Panpiglione *et al.*, 1987; Lo *et al.*, 1989; Mercado & Arias, 1995; Tena *et al.*, 1998). In contrast, *H. nana*, a species related to *H. diminuta* is more commonly reported in human since the former can be transmitted to human even without an intermediate host (de Carneri, 2004).

In Malaysia, there have been only two documented cases of *H. diminuta* in human, both of which eggs were accidentally detected by faecal examination without a clear history of clinical manifestation and possible source of infection. The first report of *H. diminuta* infection was documented from a mass faecal screening in a group of oil palm workers (Sinniah, 1978). The second case was detected during a survey exercise in Sabah, East Malaysia (Kan *et al.*, 1981). To the best of our knowledge, the present finding is the first to provide a detailed case report of *H. diminuta* infection in a 2-year-old Malaysian girl with the identification of eggs in proglottids of *H. diminuta* excreted from her anus.

Hymenolepis diminuta infection has also been noted in Thailand (Wiwanitkit, 2004), Singapore (Paul & Zaman, 1969) and Indonesia (Stafford *et al.*, 1980). In contrast, other Southeast Asian countries such as Cambodia, Myanmar, Laos PDR, Philippines and Brunei have had no documented case. Although it is believed that human infection does exist in these countries, the cases might have gone unreported due to lack of expertise in making a diagnosis. Recently, a case of *H. diminuta* infection has been reported in a 2-year- old boy living in a suburban area of Catania, Italy (Patamia *et al.*, 2010) and previous to that a 2-year-old boy was also infected by *H. diminuta* in an urban area of Rome (Marangi *et al.*, 2003). In Spain, a few cases have been reported so far, and all of them involved children (Buen, 1914; Guevara & Dominguez, 1955; Vasallo & Gonzales, 1979; Velasco *et al.*, 1980). Likewise, in rural India, *H. diminuta* eggs were found in faeces of a 12-year-old girl living in a small village (Watwe & Dardi, 2008). Elsewhere, the first documented case of *H. diminuta* infection has also been reported in a Jamaican child (Cohen, 1989).

With regards to the present case, the patient lives in a semi-rural area which is heavily infested with rodents and cockroaches. This child may have become infected via accidental ingestion of insect containing the cysticercoid larva of *H. diminuta*. Evidence of the source of infection (infected rat) has been found in other human cases observed in developed countries (Marangi *et al.*, 2003). However, some findings reported in Italy revealed that inspection of the house and its surroundings as well as all the places habitually visited by the infected human found no evidence of

rodent or other possible sources of infection (Marangi *et al*., 2003; Patamia *et al*., 2010).

Although *H. diminuta* infection is often asymptomatic, abdominal pain (Acha & Szyfres, 1984; Baily, 1996), irritability (Velasco *et al*., 1980; Acha & Szyfres, 1984; Varghese *et al*., 1998), transient thoracic rash and diffuse cutaneous itching (Patamia *et al*., 2010) have been associated with this condition. *H. diminuta* infection may also cause eosinophilia (Baily, 1996) but in our case, it was not evident. Similar finding have been reported in other *H. diminuta* infected cases (Tena *et al*., 1998; Marangi *et al*., 2003; Wiwanitkit, 2004). Eosinophilia is not usually observed in infections with helminths that reside in the lumen of the human intestine such as *H. diminuta*. Nevertheless, helminth infections may affect the expression of an allergic disease and in certain situations they may be associated with the decrease or increase or no risk of atopic conditions (Cooper *et al*., 2003).

In our case, before the sample was referred to the Para:SEAD Laboratory, the emitted proglottids have been examined on two different occasions in a private laboratory and the child was misdiagnosed as negative for any infection, leading to a delayed diagnosis and treatment. Similarly, a *H. diminuta* case was misdiagnosed as *Dipylidium caninum* infection in a private clinic in Italy (Patamia *et al*., 2010). This incident highlights that parasitological diagnosis requires an adequate laboratory with well trained and experienced personnel.

Although it is known that *H. diminuta* infection in human is asymptomatic and untreated individuals recover spontaneously with time, praziquantel is the drug of choice for its treatment, but niclosamide has also been reported to be effective (Jones, 1979; Marangi *et al*., 2003). Nonetheless, care should be taken before any drug regimen is prescribed depending on the case and patient's condition due to the fact that a drug has its advantages and disadvantages. As such, the safety of praziquantel in children is far from being adequately demonstrated. Niclosamide can be an alternative drug which seemed to be equally effective and relatively non-toxic as previously reported (Jones, 1979; Marangi *et al*., 2003). For instance, it has been demonstrated that oral niclosamide was used instead of praziquantel for the treatment of *H. diminuta* in 2-year-old boy in Italy considering the patient's neurological disease, which proved similarly efficient (Marangi *et al*., 2003). However, a case report from Spain demonstrated the ineffectiveness of niclosamide compared to praziquantel (Tena *et al*., 1998). In our case, the child recovered well after being treated with a single dose of praziquantel (20 mg/kg of body weight).

Given the lack of data regarding treatment protocols and parasitological responses, we recommend that any case of *H. diminuta* infection in human to be reported in order to improve our knowledge of the epidemiology and transmission route of this rare human infection as previously suggested in other cases (Tena *et al*., 1998; Marangi *et al*., 2003; Patamia *et al*., 2010).

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