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ENTEROBIASIS VERMICULARIS AND ITS MAGNITUDE IN EGYPT

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Abstract

Enterobius vermicularis (pinworm) is one of the most common nematode infections worldwide. Enterobiasis occurs in both temperate and tropical climates; it is the most common helminthic infection, and man is the only host particularly school and pre-school aged children of both sexes. Occasionally a superficial bacterial infection can occur at the scratching sites of intense perianal pruritus and genitourinary infections like vulvovaginitis, urinary tract infection in young girls.

Keywords: Enterobiasis, Evolution, pathogenicity, diagnosis, treatment, Mini-review

Introduction

Originally, E. *vermicular* was named *Oxyuris vermicularis.* The worm is named after the characteristic pin-like tail present on female posterior part evidenced by eggs found in coprolite, carbon dated to 7837BC at western Utah (Cook, 1994). Worms are tiny, thread-like, sometimes lives in the colon and rectum of humans, about the length of a staple and whitish in color (Rawla and Sharma, 2022). Humans are the only natural host and transmission occurs among people living in crowd-ed environments and usually occurs within families (Markell, 1985).

Review and General Discussion

Evolution: Horne (2002) in Canada reported that studies from the Old World were scarce, but first evidence of infection was from Roman-occupied (30BC-AD395) Egypt. Also, Sorci *et al*. (2003) in France reported that female *E. vermicularis* body size was negatively correlated with eosinophil concentration, whereas two concentration of other leucocyte families-neutrophils and lymphocytes didn't related to female size, and added that egg size decreased with host eosinophil concentration, independently of female body size. Male size was unrelated to host immune parameters, and those primates with highest immune defense, and so harbored small female laying small eggs. Foitová *et al.* (2014) in France did the first ever molecular analysis to study the phylogenetic position of the newly pinworms parasitizing the Sumatran Orangutan. Hasegawa and Udono (2007) reported that scarcity of mixed chimpanzee *E. anthropopitheci* with *E. vermicularis* suggested an interspecific competition. Steverding (2020) in UK reported that all different forms of migration played the major role in the parasitic introduction into new areas, and that in ancient times, mass migrations were the main cause for diseases' spread, but in the recent past and present, immigration, displacement, and labor migration dispersed the infectious parasites worldwide.

Life cycle and transmission: *E. vermicularis* has a simple life cycle begins with egg deposition by gravid adult female worms on the perianal folds, which are hardy and remain infective in a moist environment for up to three weeks (Jones, 1988). Infection is caused by the ingestion of the pinworm eggs. Transmission is commonly via the fecal-oral route or direct contact with eggs contaminated environmental surface (curtains, carpeting…etc.). Also, person-to-person transmission occurs by eating food touched by patient contaminated hands or by handling contaminated clothes or bed linens. Infection commonly occurs in children, but any individual is susceptible to *E. vermicularis* infection. People from tropical climates mainly school-aged children are the most vulnerable. Autoinfection occurs by scratching the perianal area and transferring infective eggs to the mouth with contaminated hands (Ashford *et al*, 1988). Following ingestion of infective eggs, the larvae hatch in the small intestine and the adults establish themselves

in the colon, usually in the cecum. The time interval from ingestion of infective eggs to deposition of ova by the adult females is about one month. At full maturity adult females measure 8 to 13 mm, and adult males 2 to 5 mm; the adult life span is about two months. Gravid females migrate nocturnally outside the anus and oviposit while crawling on the skin of the perianal area. The larvae contained inside the eggs develop (the eggs become infective) in 4 to 6 hours under optimal conditions. Rarely, eggs may become airborne and be inhaled and swallowed. Retro-infection, or the migration of newly hatched larvae from the anal skin back into the rectum, may occur but the frequency with which this happens is unknown. Man is the only *E. vermicularis* host, although occasional infections were in chimpanzees and rabbits (CDC, 2011).

Epidemiology: Pinworms are particularly common in children with approximately 30% of children being infected and most commonly seen in children between 7 and 11 years old (Dezsényi *et al,* 2018) The male to female infection frequency is 2 to 1 (An *et al,* 2012). But, a female predominance of infection is common between the ages of 5 & 14 years. It most commonly affects children younger than 18 years of age, also commonly in adults who take care of children and institutionalized children by swallowing of inhaled eggs (Prashanth and Sharma 2021).

Clinical manifestations: About a third of patients with *E. vermicularis* are asymptomatic. The most common symptom associated with pinworm infestation is perianal itching. Worms may be visible to the naked eye in the perianal area. Perianal erythema occurs due to the itching and scratching. Sometimes a superficial bacterial infection can occur at the scratching sites resulting in erythema and warmth (Tietze and Jones, 1991). Persistent itching can cause disturbances in sleep and may lead to insomnia. Watery diarrhea, abdominal pain and appendicitis can occur due to the worms blocking lumen in the appendix or lead to inflammation around the appendix (Dahlstrom and Macarthur, 1994). Occasionally, the worm burden is so high to develop abdominal pain, nausea, and vomiting. Adult pinworms may be found in normal and inflamed appendices following surgical removal, but whether or not they cause appendicitis was debated (da Silva *et al,* 2007). Eosinophilic enterocolitis occurred via peripheral eosinophilia was not seen (Liu *et al,* 1995). But, *E. vermicularis* cases in appendectomy histopathological specimens were reported (Arca *et al,* 2004).

In addition, adult worms can migrate to extra intestinal sites, vulvovaginitis has been described that can increase susceptibility to urinary tract infections (Cacopardo *et al,* 1997) Involvement of other genitourinary sites was described including salpingitis, oophoritis, cervical granuloma, and peritoneal inflammation, with *Enterobius* of nasal mucosa was reported (Vasudevan *et al,* 2003).

Diagnosis: Diagnosis relies on finding eggs or the adult pinworms (Garcia and Shore, 2009). Individual eggs are invisible to the naked eye, but they can be seen using a low-power microscope (Caldwell, 1982). On the other hand, the light-yellowish thread-like adult pinworms are clearly visually detectable, usually during the night when they move near the anus, or on toilet paper (Burkhart and Burkhart, 2005). Shining a flashlight on the infected individual's anus about one hour after they fall asleep is one form of detection and may show worms crawling out of the anus (Stermer *et al,* 2009). Another form of detection is the use of transparent adhesive tape (Scotch Tape) applied on the anal area which will pick up deposited eggs, and diagnosis can be made by examining the tape with a microscope (Gutiérrez and Yezid, 2000). This test is most successful if done every morning for several days, because the females do not lay eggs every day, and the number of eggs varies. A third method of diagnosis is examining a sample from under their fingernails under a microscope as itching around the anal area is common and thus they may have collected some eggs under

their nails as a result (CDC, 2019). Pinworms do not lay eggs in the feces, but sometimes eggs are deposited in intestine. In a heavy infection, female pinworms may adhere to stools that pass out through anus, and can be detected on stool surface. Adult can be detected during colonoscopy. On a macroscopic level, pinworms have an identify feature (Cook, 1994).

Treatment: Albendazole given on an empty stomach, a 400-mg, one-time dose followed by a repeat dose in 2 weeks OR Mebendazole: A 100-mg, one-time dose followed by a repeat dose in two weeks OR Pyrantel Pamoate: Available over the counter in the United States; Dose of 11 mg/kg up to a maximum 1gm given 2 weeks apart. Other medications that have been used to treat enterobiasis are ivermectin and piperazine, although the latter has lower efficacy and higher toxicity (Belizario *et al,* 2003). Enterobiasis can cause recurrent reinfection, so treating the entire household, whether symptomatic or not is recommended to prevent a recurrence. Because the drugs kill the adult pinworms, not eggs, thus first retreatment is recommended in two weeks (Bartoloni *et al,* 1993). Young pinworms tend to be resistant to treatment and hence two doses of medication, two weeks apart are recommended. At the same time, all members of the infected child must be treated. If a large number of children are infected in a class, everyone should be treated twice at 2-week intervals. Follow up is vital to ensure that a cure has been obtained (Yang *et al*, 2017). Besides, garlic oral on empty stomach or as suppository has been used as a treatment in ancient cultures of China, Egypt, Greece and India (Petrovska and Cekovska, 2010). Total enterobiasis elimination in the household may require repeated doses of medication for up to a year or more due to auto & retro-infection (Cranston *et al,* 2015)

Treatment in pregnancy and breast-feeding: Data on mebendazole, albendazole, and pyrantel pamoate use in pregnancy is limited and they are all assigned to pregnancy category level C. Treatment of a pinworm infection during pregnancy is only recommended for patients with significant symptoms that may be causing adverse effects to the pregnant person such as loss of sleep and weight (Henley and Sears, 1985). Pyrantel pamoate is the treatment of choice in pregnancy but, should be used only after consultation with a health care physician rather than self-treatment (Prashanth and Sharma, 2021). Treatment should be avoided in the first trimester, and if possible done in the third trimester. If the pregnant individual is asymptomatic, then they must be treated after the baby delivery. Mebendazole has less than 10% of the oral dose absorbed into systemic circulation with a clinically insignificant amount of drug excreted in breast-milk, and thus treatment should not be withheld during breastfeeding. There was limited data on pyrantel pamoate and albendazole use in breastfeeding but WHO also classified them as compatible with breastfeeding due to the drugs acting mainly in the intestinal system of a mother with only a very small amount of drug was absorbed into systemic circulation (Heukelbach *et al,* 2004)

Prognosis: Prognosis following a pinworm infection is excellent. Patients are recommended to follow up with their physicians after completion of the treatment to make sure they do not have any reinfection. Its symptoms recur then testing and treatment as above should be re-initiated. Ectopic pinworm infections were described in many organs including the vagina, inguinal area, genitals, peritoneum, liver, oral cavity, lungs, and pelvis (Yildirim *et al,* 2005). Also, there are even reported cases of appendicitis caused by impaction of the organ by pinworms. While death is very rare, recurrences are common. Eradicating pinworms from institutions is very difficult and long term surveillance request. To completely eradicate the pinworm, everyone in the classroom or in the family has to be treated. Occasionally a superficial bacterial infection can occur at the scratching sites due to intense perianal

pruritus. Others were female genitourinary infections like vulvo-vaginitis, urinary tract infection in young girls, appendicitis was due to a consequence of the longstanding infection (Dahlstrom and Macarthur, 1994).

Prevention: The main measures are keeping fingernails short and washing and scrubbing hands and fingers carefully, especially after defecation and before meals. Showering every morning is also highly recommended to wash off any eggs that may be still lying on the skin. Under ideal conditions, bed covers, sleeping garments, and hand towels must be changed daily and clothes and linens should be washed in hot water and then placed in a hot dryer in order to kill off any eggs (Gatti *et al,* 2000). Children can wear gloves while asleep, and the bedroom floor should be kept clean. Regular disinfection of kitchen and bathroom surfaces will help to prevent spr-ead as well. Food should be covered to limit contamination with dust-borne parasite eggs. It is not recommended to shake clothes and bed linen as the eggs may detach and spread or to share clothes and towels. Nail biting and sucking on fingers is also discouraged (CDC, 2020).

Infection may occur in the highest strata of society, where hygiene and nutritional status are typically high. The stigma associated with pinworm infection is hence considered a possible over-emphasis. The counseling is sometimes needed for upset the parents who have discovered their children are infected, as they may not realize how prevalent the family infections (Zoorob, 1996).

In Egypt: Morsy *et al.* (1991) in two primary schools in Qualyob City reported in descending order head lice, *E. vermicularis, Hymenolepis nana, G. lamblia* and *A. lumbricoides.* Younis *et al.* (1997) also in Qualyobia villages reported the commonest was *Schistosoma mansoni* followed by *E. vermicularis*. El Shazly *et al.* (2006) in Dakahlia reported that nematodes were *Trichostrongylus* sp. (2.6%), *Strongyloides stercoralis* (1.5%), *E. vermicularis* (1.1%) and *T. trichura* (0.7%). Eraky *et al.* (2014) in Benha City among inhabitants eating raw vegetables, parasites (157/530) were *Giardia lamblia* (8.8%) followed by *Entamoeba* spp. cysts (6.8%), *E. vermicularis* eggs (4.9%), various helminth larvae (3.6%), *Hymenolepis nana* eggs (2.8%), *H. diminuta* eggs (2.1%), and *A. lumbricoides* eggs (0.6%). Mohammad *et al*. (2012) in Damietta City reported parasites among the rural & urban school students were *E. histolytica, E. vermicularis, G. lamblia, H. nana, A. lumbricoides* and *S. mansoni* and commonest double infections were *E. histolytica* and *E. vermicularis*. Dyab *et al*. (2016) among children aged from 6 to 12 years in Aswan Governorate reported parasitic infection was more in boys (53.8%) than girls (46.2%) and more prevalent in rural areas (60%) than urban (30%). The commonest helminthes were *E. vermicularis* 6.6% followed by *Hymenolepis nana* 3% *Ascaris lumbricoides* 1%. Mixed infection was in form of *E. vermicularis* with *E. histolytica* (23.4%), *E. vermicularis* with *G. lamblia* (17.6%), *E. vermicularis* with *Cryptospordium parvum* (11.8%), *E. histolytica* with *H. nana* (11.85%,) *Ascaris lumbricoides* with *E. histolytica* (17.6%), *G. lamblia* with *E. histolytica* (11.8%).

Radwan *et al*. (2019) in Damanhur, Beheira found that children less than 10 years were more infected (57.3%) than those above 10 years (47.1%), and parasites were 42.2% in urban areas with open sewage channels. The commonest parasite was *E. vermicularis* followed by *A. lumbricoides* with significant difference as to the socio-economic levels.

Elmonir *et al.* (2021) in Gharbia Governorate found parasites in the descending order among pre & school aged children were *E. histolytica* (12.7%), *A. lumbricoides* (12.7%) *E. vermicularis* (8.6%), *G. lamblia* (7.1%), *Cr. parvum* (1.5%), *H. heterophyes* (1.4%), *H. nana* (0.7%), Hookworms (0.6%), *F. hepatica* (0.5%) and *D. caninum* (0.4%).

Ahmed and Abu-Sheishaa (2022) in Dakahlia urban and rural school children, the parasites were *E. histolytica*, *G. lambilia*, *H. nana*, and *E. vermicularis*, with highly signi-

ficant differences as to the environmental & behavioral variables and GIT symptoms

Conclusion and recommendations

Enterobiasis also called pinworm is one of the most common nematode infections in the world. Infection most commonly occurs in children, but any individual is susceptible to *E. vermicularis* infection. People from tropical climates and school-aged children are the most vulnerable. Transmission is via direct contact with contaminated items or even during sexual contact. Most infections are asymptomatic. While the cure rate is high, recurrences are common.

Risk factors for pinworms include poor hygiene, eating after touching contaminated items and living with an individual who is identified as egg positive. Patients should be educated on the need to maintain hygiene and wash their hands regularly to prevent the spread of infection and reinfection.

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