ENTEROBIUS VERMICULARIS

History and Distribution

Enterobius vermicularis, the human pinworm, threadworm or seatworm, formerly called

Oxyuris vermicularishas been known from ancient times. The name Enterobius

vermicularismeans a tiny worm living in the intestine (Greek enteron—intestine, —bios

life and vermiculus—small worm). The term Oxyuris means ‘sharp tail’, a feature

.of the female worm, from which the name ‘pinworm’ is also derived

It is worldwide in distribution. Unlike the usual situation where helminthic

infections are more prevalent in the poor people of the tropics, E.vermicularisis one

worm infestation which is far more common in the affluent nations in the cold and

.temperate regions

Morphology

The adults are short, white, fusiform worms with pointed ends, looking like bits

of white thread. The mouth is surrounded by three wing-like cuticular expansions

cervical alae) which are transversely striated. The oesophagus has a double-bulb)

.structure, a feature unique to this worm

The male is 2 to 5 mm long and 0.1 to 0.2 mm thick. Its posterior end is tightly

curved and carries a prominent copulatory spicule. The female is 8 to 13 mm long

and 0.3 to 0.5 mm thick. Its posterior third is drawn into a thin pointed pin-like

tail. The vulva is located just in front of the middle third of the body and opens

into the single vagina which leads to the paired uteri, oviducts and ovaries. In the gravid female, virtually the whole body is filled by the distended uteri carrying .thousands of eggs

(Biology and Life Cycle (Fig. 16.1

E. vermicularisis monoxenous, passing its entire life cycle in the human host. It has .no intermediate host

Fig. 16.1: Life cycle of Enterobius vermicularis.1. Adult worms in caecum. Note cervical alae and oesophagus with double-bulb. Body of gravid female filled with paired uteri loaded with eggs. Posterior third pin-like. Male has tightly coiled posterior. 2. Inset showing actual sizes of adult female and male. 3. Plano-convex egg containing tadpole-shaped embryo, deposited by gravid female worm .on perianal skin. 4. Mature egg containing infective larva

Infection by ingestion of mature egg .٥

The adult worms live in the caecum, appendix and adjacent parts of the ascending colon. The male is seldom seen as it does not migrate. It usually dies after mating and is passed in the feces. The gravid female migrates down the colon to the .rectum

At night when the host is in bed, the worm comes out through the anus and crawls about on the perianal and perineal skin to lay its sticky eggs. The worm may retreat

into the anal canal and come out again to lay more eggs. The worm may wander

into the vulva, vagina and even into the uterus and fallopian tubes, sometimes reaching

the peritoneum. A single worm lays from 5000 to 17,000 eggs. When the eggs are

all laid, the worm dies or gets crushed by the host during scratching. The worm

may often be seen on the feces, having been passively carried from the rectum. The

.eggs, however, are only infrequently found in feces

The egg is colourless and not bile stained. It has a characteristic shape, being elongated ovoid. flattened on one side and convex on the other (planoconvex), measuring

to 60 µm by 20 to 30 µm.The egg shell is double layered and relatively thick, ٥٠ though

transparent. The outer albuminous layer makes the eggs stick to each other and to

clothing and other objects. The egg contains a tadpole shaped coiled embryo which is

fully formed, but becomes infectious only some 6 hours after being deposited on the

.skin. Under cool moist conditions, the egg remains viable for about 2 weeks

When eggs containing infective larvae are swallowed, they hatch out in the

intestine. They moult in the ileum and enter the caecum, where they mature into

adults. It takes from 2 weeks to 2 months from the time the eggs are ingested, to

.the development of the gravid female, ready to lay eggs

Clinical Features

The infection occurs mostly in children. It is more common in females than in .males

The worm produces intense irritation and pruritus of the perianal and perineal area

when it crawls out of the anus to lay eggs. This leads to scratching and excoriation

.of the skin around the anus. As the worm migrates out at night, it disturbs sleep

.Nocturnal enuresis is sometimes seen

The worm crawling into the vulva and vagina causes irritation and a mucoid

discharge. It may migrate upto the uterus, fallopian tubes and into the .peritoneum

.This may cause symptoms of chronic salpingitis

The worm is sometimes found in surgically removed appendix and has been claimed

.to be responsible for appendicitis

Epidemiology

Enterobiasis is generally a group infection, found in a group of children in a class

.or boarding school or in a family

Enterobiasis is less common in the tropics probably because children there often

wear less underclothes and wash more frequently. The eggs are destroyed by the

desiccation in the hot weather. In the cold countries people wear close fitting

undergarments and use many layers of bed clothes. This facilitates transmission of

.the infection

The source of infection is an infected person. Thousands of eggs are laid on the

perianal skin. Scratching transfers them to the fingers, in the dirt beneath the .nails

These are carried to the patient’s own mouth (auto-infection) during eating or

nailbiting, and to contacts either directly or through food and fomites. The eggs

.survive in the dust for some days and get airborne during sweeping or bedmaking

When inhaled, the eggs may stick to mucus and be swallowed. A process of retrograde

infection (retrofection) has been described, in which the eggs laid on the perianal

skin hatch there itself and the larvae migrate back to the anus and up the colon

.to the caecum, to develop into adults

As the worm does not multiply in the host and has a lifespan of only about 2

weeks to 2 months, the infection should get automatically eliminated after that .period

FIGURE 16.2: Pinworm adult

However, in some children, the infection persists for long periods. This is due to

autoinfection. The importance of retrofection in prepetuation of infection is not .known

Diagnosis

Pinworm infestation can be suspected from the history of perianal pruritus. Diagnosis

depends on the demonstration of the eggs or adult worms. Eggs are present in

the feces only in a small proportion of patients and so feces examination is not

useful in diagnosis. They are deposited in large numbers on the perianal and perineal

skin at night and can be demonstrated in swabs collected from the sites early

morning, before going to the toilet or bathing. Swabs from perianal folds are most

often positive. The NIH swab (named after National Institutes of Health, USA) has

been widely used for collection of specimens. This consists of a glass rod at one

.end of which a piece of transparent cellophane is attached with a rubber band

The glass rod is fixed on a rubber stopper and kept in a wide test tube. The

.(cellophane part is used for swabbing by rolling over the perianal area (Fig. 16.3

It is returned to the test tube and sent to the laboratory, where the cellophane piece is detached, spread over a glass side and examined microscopically. Another method for collection of specimens is with Scotch tape (adhesive transparent cellophane tape) held sticky side out, on a wooden tongue depressor. The mounted

tape is firmly pressed against the anal margin, covering all sides. The tape is transferred to a glass slide, sticky side down, with a drop of toluene for clearing

.and examined under the microscope

The eggs may sometimes be demonstrated in the dirt collected from beneath the finger nails in infected children. The adult worms may sometimes be noticed on the surface of stools. They may occasionally be found crawling out of the anus while the children are asleep. They may be demonstrated in stools collected after

.an enema

FIGURE 16.3: NIH swab. A piece of transparent
cellophane is attached with rubber band to one end
of a glass rod which is fixed on a rubber stopper
and kept in a wide test tube

Treatment

,Several effective drugs are available for the treatment of enterobiasis. Pyrantel pyrvinium and mebendazole can be used for single dose therapy, while piperazine

has to be given daily for one week. It is necessary to repeat the treatment after two weeks to take care of autochthonous infections and ensure elimination of all worms. As pinworm infection usually affects a group, it is advisable to treat the .whole family, or group of children, as the case may be

Control

Health education on personal and community hygiene and group chemotherapy .constitute the control measures

Roundworm

CHAPTER 17

ASCARIS LUMBRICOIDES

History and Distribution

The roundworm, Ascaris lumbricoidesis the largest nematode parasite in the human

intestine. It had been observed and described from very ancient times, when it was

sometimes confused with the earthworm. Its specific name lumbricoidesis derived

from this resemblance (Lumbricus, meaning earthworm in Latin). It is the most common

of human helminths and is distributed worldwide. A billion people are estimated ,to be infected with roundworms. The individual worm burden could be very high even up to over a thousand. An editorial in the Lancetin 1989 observed that if all the roundworms in all the people worldwide were placed end-to-end they would .encircle the world 50 times

Morphology and Life Cycle

The adult worms live in the small intestines of infected persons. They are large cylindrical worms, with tapering ends, the anterior end being more pointed than ,the posterior. They are pale pink or flesh coloured when freshly passed in stools but become white outside the body. The mouth at the anterior end has three finely .denticulated lips, one dorsal and two ventro-lateral

The male measures 15 to 30 cm in length and 2 to 4 mm in thickness. Its posterior end is curved ventrally to form a hook and carries two copulatory spicules. The female is larger, 20 to 40 cm long and 3 to 6 mm thick. Its posterior extremity is straight and conical. The vulva is situated mid-ventrally, near the junction of the anterior and middle thirds of the body. A distinct groove is often seen surrounding the worm at the level of the vulvar opening. This is called the vulvar waist or genital girdle and is believed to facilitate mating (Fig. 17.1). The vulva leads to a single vagina, which branches into a pair of genital tubules that lie convoluted through much of the posterior two thirds of the body. The genital tubules of the gravid worm contain an enormous number of eggs as many as 27 million at a time. A single .worm lays up to 200,000 eggs per day. The eggs are passed in faeces

Two types of eggs are passed by the worms. The fertilised eggs, laid by females inseminated by mating with a male, are embryonated and develop into the infective

eggs. The uninseminated female also lays eggs, but these are non-embryonated and

.cannot become infective. These are called unfertilised eggs

FIGURE 17.1: Ascaris lumbricoides. A. Adult male

and female worms. Note the vulvar waist (v) in

the female and the ventrally curved posterior end

in the male with copulatory spicules(s). B. Anterior

end of worm. head-on view, showing one dorsal

.D) and two ventral. (V) lips, with papillae (P). C)

Posterior end of male, showing two protruding

,copulatory spicules(s). D. Posterior end of female

showing anal opening (A) a little above the conical

tip

The fertilised ascaris egg is spherical or ovoid, bile stained to a golden brown

colour and measures 60 to 75 µm in length and 40 to 50 µm in breadth. It is enclosed

in a stout translucent shell consisting of three layers, the outer coarsely mamillated

albuminoid coat a thick transparent middle layer and the inner lipoidal vitelline

membrane. Some eggs are found in feces without the outer mamillated coat. They

are called the decorticated eggs. In the middle of the egg is a large unsegmented ,ovum

containing a mass of coarse lecithin granules. It nearly fills the egg, except for a

.clear crescentic area at either pole

The unfertilised egg is longer, up to 90 µm, and more elliptical. The shell is thinner

with the outer mamillary coat scanty and irregular. The ovum is atrophic and contains

numerous disorganised, highly refractile granules of various sizes. The unfertilised egg is relatively heavy and does not float in saturated salt solution used for concentration by salt floatation while the fertilised eggs float. Stool samples may .(show both fertilised and unfertilised eggs, or either type alone (Fig. 17.2

The fertilised egg passed in feces, is not immediately infective. It has to undergo a period of incubation in soil before acquiring infectivity .The eggs are resistant to adverse conditions and can survive for several years. The development of the

FIGURE 17.2: Types of ascaris eggs found in stools. 1. Fertilised egg surface focus. showing outer mamillary coat. 2. Fertilised egg. median focus. showing unsegmented ovum surrounded by three layers of coats. 3. Decorticated fertilised egg. The mamillary coat is absent. 4. Unfertilised egg. Elongated, with atrophic ovum. 5. Decorticated unfertilised egg

.egg in soil depends on the nature of the soil and various environmental factors

A heavy clayey soil and moist shady location, with temperature between 20° and C are optimal for rapid development of the embryo. The development usually°٣٠ takes from 10 to 40 days, during which time the embryo moults twice and becomes

.the infective rhabditiform larva, coiled up within the egg

Infection occurs when the egg containing the infective rhabditiform larva is swallowed. A frequent mode of transmission is through fresh vegetables grown in fields manured with human feces (‘night soil’). Infection may be transmitted through contaminated drinking water. Children playing about in mud can transmit

eggs to their mouth through dirty fingers. Where soil contamination is heavy due

to indiscriminate defecation, the eggs sometimes get airborne along with windswept

.dust and inhaled. The inhaled eggs get swallowed

When the swallowed eggs reach the duodenum, the larvae hatch out. The

rhabditiform larvae, about 250 µm in length and 14 µm in diameter, are actively

motile. They penetrate the intestinal mucosa, enter the portal vessels and are carried

to the liver. They then pass via the hepatic vein, inferior vena cava and the right

.heart, and in about four days reach the lungs, where they grow and moult twice

After development in the lungs, in about 10 to 15 days, the larvae pierce the lung

capillaries and reach the alveoli. Then they crawl up or are carried up the respiratory

passage to the throat and are swallowed. The larvae moult and develop into adults

in the upper part of the small intestine. They become sexually mature in about 6

to 12 weeks and the gravid females start laying eggs. to repeat the cycle. The adult

.(worm has a lifespan of 12 to 20 months (Fig. 17.3

Pathogenesis and Clinical Features

Clinical manifestations in ascariasis can be caused by either the migrating larvae

.or the adult worms

The pathogenic effects of larval migration are due to allergic reaction and not

the presence of larvae as such. Therefore, the initial exposure to larvae is usually

asymptomatic, except when the larval load is very heavy .But when reinfection occurs

subsequently there may be intense cellular reaction to the migrating larvae in the

Roundworm 191

FIGURE 17.3: Life cycle of Ascaris lumbricoides. 1. Adult worms

.in small intestine of man. 2. Egg passed in feces reaches soil

Mature egg containing larva— infective for humans. 4. When .٣

swallowed, larva hatches out in duodenum. 5. Rhabditiform larva

,penetrates gut wall, circulates in blood stream, moults in lung

reaches pharynx and is swallowed to develop into the adult in

intestine

lungs, with infiltration of eosinophils, macrophages and epithelioid cells. This ascaris

,pneumonia is characterised by low grade fever, dry cough, asthmatic wheezing

urticaria, eosinophilia and mottled lung infiltration in the chest radiograph. The sputum

may contain Charcot-Leyden crystals. The larvae may occasionally be found in the