WORLD HEALTH ORGANIZATION

ORGANISATION MONDIALE DE LA SANTE

PDP/EC/WP/86.16

ENGLISH ONLY

EXPERT COMMITTEE ON PREVENTION AND CONTROL OF INTESTINAL PARASITIC INFECTIONS

Geneva, 3-7 March 1986

Draft agenda item 5

PUBLIC HEALTH SIGNIFICANCE OF ABDOMINAL ANGIOSTRONGYLIASIS

by

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Introduction

For many years, abdominal angiostrongyliasis (AA) caused by Angiostrongylus costaricensis (Morera & Cespedes, 1971) has been considered a human parasitic zoonosis of academic importance only. Although the disease has been found in several Latin American countries (Agostini, 1983; Barbosa, 1980; Sauerbrey, 1977; Zambrano, 1973; Zavala, 1974; Ziliotto, 1975; Zuniga, 1983), in most cases its finding has been the result of the routine examination of surgical specimens in pathology departments. However, in areas where clinical knowledge and the methodology for laboratory diagnosis have been improved, it is becoming clear that this is quite a prevalent parasitic disease. On the other hand, most clinical and sub-clinical cases probably go unrecognized or misdiagnosed when physicians are unaware of the problem.

Epidemiology

In Costa Rica, the most important intermediate host is the veronicellid slug Vaginulus plebeius, which is widespread from sea level up to 2000m. The infection rate of this mollusc varies from 28 to 75% with an average of 50% (6025 specimens from 20 localities) for the whole country. More than 10000 infective larvae have been found in a single specimen. In February 1985, similar work (using the same methodology) was started in Ecuador and in about 400 slugs (species to be classified) initially studied, an infection rate of 64% was found. In addition, several species of terrestrial and freshwater snails have been found naturally infected, or could be experimentally infected in the laboratory (Morera et al., unpublished).

Although the cotton rat Sigmodon hispidus is considered the most important definitive host, 11 additional rat species and one coati (Nasua narica) in Costa Rica (Monge et al., 1978) and marmosets (Saguinus mystax) from Iquitos, Peru (Sly et al., 1982) were also found naturally infected. Studies carried out in Costa Rica showed that the highest infection rate found for S. hispidus was 43.2%, similar to that found in Panama (35%) for the same species (Tesh et al., 1973). These data seem to indicate that the parasite is highly prevalent in the environment. Thus, the opportunities for humans to become infected are high.

Diagnosis

Since no larvae can be observed in human stools (as could be seen in the natural host), a highly specific (98.7%) and sensitive (100%) latex test has been developed (Morera, unpublished). By this technique, 105 positive sera were found out of 339 clinically suspected cases in 1983, and 250 out of 647 in 1984. From the last sample, 350 were also tested by micro-ELISA with similar results.

Clinical manifestations

The disease predominantly affects children, but cases in adults have been found in Costa Rica and other countries of the American Continent. In man, the parasite is usually localized, as in the natural definitive host (Morera, 1973), in the ileo-caeco-colic branches of the anterior mesenteric artery. Etopic localization in the liver and in the testicle have been also observed. When the worms are located within the caecal region, the patients usually complain of pain in the right iliac fossa and right flank, palpation being painful. Rectal examination may also be painful and most patients present with fever, seldom accompanied by chills. In chronic cases the patients may remain with a mild fever for several weeks.

If present, an important feature is the presence of a tumour-like mass that can be palpated in the lower right quadrant. If not aware of the problem, physicians can confuse these masses with maligant tumours. Although a few patients show a normal haematological pattern, leukocytosis and eosinophilia are the most important laboratory findings; in most cases the white cell count varies from 15000 to 40000wbc/mm^3, and eosinophilia from 20 to 50%. Radiological changes may be observed in the terminal ileum, caecum and ascending colon, the most important being reduction of the lumen by thickening of the intestinal wall.

When the liver is affected the patients complain of pain localized in the upper right quadrant. The palpation is painful and hepatomegaly is almost always present; leukocytosis and eosinophilia may be higher than in intestinal infections, the whole clinical picture resembling that of visceral larva migrans (Morera et al., 1982). The localization of adult worms within spermatic arteries causes obstruction of these vessels, necrosis and acute testicular pain (Ruiz & Morera, 1983).

Pathological findings

Two major pathogenic mechanisms are distinguishable in the infections caused by A. costaricensis. First, adult worms living within the arteries damage the endothelium causing thrombosis and necrosis of the tissues formerly irrigated by the obstructed vessels. Secondly, eggs, and later embryos and larvae, as well as excretion/secretion products reach the small vessels of the tissues, causing inflammatory reactions.

Combinations of these phenomena, the susceptibility of the host and the number of parasites and their localization, determine the clinical and pathological differences showed by this disease, ranging from cases in which only the appendix is involved, to those in which major surgery is required, with excision of the terminal ileum, caecum and ascending colon.

When sectioned, the intestine shows areas of necrosis and thickening of the wall, in some cases attaining 3 to 4cm. The intestinal lumen is narrowed and the mesenteric lymph nodes are usually enlarged. The thickening of the intestinal wall is caused by an inflammatory reaction which shows different patterns. In most cases, a reaction characterized by heavy eosinophilic infiltration, especially of the mucosa and sub-mucosa is seen. Eggs, embryos and larvae are located in small vessels. Sometimes, groups of epithelioid cells are present; often embryos and larvae can be seen within these granulomata. Microscopic necrotic areas are observed around degenerating embryos and larvae; these small necrotic foci, as well as those observed in the absence of parasitic structures, are caused by excretion/secretion antigens, as can be demonstrated by immuno-fluorescent antibody techniques. The larger areas of necrosis that may lead to perforation and peritonitis, are caused by the thrombosed arteries containing the adult worms.

Liver lesions caused by A. costaricensis are clinically similar to those produced by Toxocara canis. However, the pathogenesis is different. We believe that in the former, the wrong habitat is reached during the migration of the juveniles from the lymphatic vessels to the arteries, the phenomenom being caused by several factors (to be discussed later). Whatever the mechanism, in some cases the adult worms are wrongly located within veins (not arteries) of the mesentery and the eggs are carried into the liver, causing an inflammatory reaction, also characterized by heavy eosinophilic infiltration. Furthermore, adult worms may also reach the liver, and when they degenerate, extensive necrotic areas can be observed around them.

All of the excised testicles from boys that underwent surgery were necrotic and adult worms were observed obstructing the arteries of the spermatic cord.

Treatment

With improvement in diagnosis, more clinical (not surgical) cases are being found. Thus, the need for medical treatment arose, and several physicians started to use common anthelmintic drugs. However, the author posed a question: what would be the fate of a "dead" parasite within an artery, and what would be the consequence for the patient. In vitro and in vivo trials demonstrated that thiabendazole, levamisole and diethylcarbamazine, do not kill the parasites, but excite them causing erratic migrations and the death of experimentally infected rats that otherwise would not die (Morera & Bontempo, in press). Similar results are being obtained with albendazole, and other drugs are scheduled to be tested.

Important remarks

In experimentally infected rats some anthelmintic drugs can provoke abnormal migrations of the worms. The same effect might occur in humans, which could explain the ectopic localization in the liver and testicle. Therefore, it is a matter of concern to see the liberality with which these drugs are being used in endemic areas indiscriminately and without even medical prescription. In addition, in reporting the first proved case of liver infection by A. costaricensis, we stated that 22 days before the abdominal illness, the patient had parotitis with high fever. Thus, one important question is, could fever be one of the factors that cause these erratic migrations of the parasites?

The most important source of infection for human beings is likely to be infective larvae shed in the mucous secretions of slugs. In Costa Rica, the average slug infection rate is 50%. In Ecuador, a preliminary study showed 64% of infection in molluscs collected in two localities of the Guayas province. However, no human cases have been reported there. As far as I know, with the exception of Brazil (Rio Grande do Sul), no similar studies are being carried out in other countries.

Slugs also represent an important agricultural plague, beans apparently being the major target. In a recent seminar on this subject in Honduras, it was reported that 10 years ago 12000 hectares were seeded with beans in a single department of that country; last year, the area dedicated to this crop dropped to 5000 hectares, and peasants are abandoning the land. Almost all of the loss is attributable to the slug plague. Are pesticides destroying the biological controls of molluscs and so increasing their populations and the opportunities for humans to become infected?

Infected rats have been found from Texas (USA) to Cali (Colombia). However, in Brazil, for instance, human cases have been reported from Sao Paulo, Botucatu, Brasilia, and Rio Grande do Sul, but no reports on infected animals have been published.

Coatis in Costa Rica and marmosets in the Amazon area of Peru, have been found infected. In addition, we found several forest rodents naturally infected. These data seem to indicate that a wild cycle is likely to be widespread throughout the continental forests, probably involving several species of mammals and molluscs.

In 1984 we diagnosed 250 cases of abdominal angiostrongyliasis (AA), giving an infection rate of 10 per 100000 inhabitants, higher than several well known communicable diseases. Furthermore, these figures represent only those cases clinically suspected by physicians that are aware of the problem (about 15% of the medical population of the country). It is our opinion that the difference between the data of 1983 and 1984 is attributable to this factor.

Almost all of the cases found outside Costa Rica were diagnosed in surgical specimens. We do not believe that there are any special environmental conditions which could account for the huge differences between our figures and those of neighbouring countries. At the moment, the most important factor that determines the geographical distribution of AA is awareness of the problem by the medical personnel. This being so, the above mentioned figures probably represent only the tip of an iceberg.

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