

II. DISTOMIASIS.

Several forms of trematodes or flukes are parasitic in man, and when in numbers may cause serious disease.

(1) *Liver Flukes*.—The following varieties of flukes have been found: The *distoma hepaticum*, a very common parasite in ruminants, which has a length of from twenty-eight to thirty-two millimetres. The *distoma lanceolatum*, a much smaller form, from eight to ten millimetres in length, which is also very common in sheep and cattle. The *distoma crassum*, the largest form, measuring from four to eight centimetres in length. One or two other less important forms have occasionally been met with. The studies of the Japanese physicians have brought to light the interesting fact that there is a distoma widely endemic in certain provinces in that country. Two forms have been described, the *distoma endemicum* and the *distoma perniciosum*, about which there is still a doubt whether they are different species or not. The studies of Ijima indicate that they are probably the same. According to Baelz, fully twenty per cent of the inhabitants of certain provinces are affected.

The flukes occupy the bile-passages and the upper portion of the small intestine. When in large numbers they may cause serious and fatal disease of the liver, usually with ascites and jaundice. The liver may be enormously enlarged; in Kichner's case it weighed eleven pounds. The flukes may cause a chronic cholangitis, leading to great thickening or even calcification of the walls of the bile-duct.

The endemic fluke disease of Japan is characterized by enlargement of the liver, emaciation, diarrhoea, and frequently ascites.

(2) *The Blood Fluke; Bilharzia Hæmatobia*.—This trematode is found in Egypt, southern Africa, and Arabia, and is the cause in these countries of the endemic hæmaturia. The female is about two centimetres in length, cylindrical, filiform, and about .07 millimetre in diameter. The parasite lives in the venous system, particularly in the portal vein, and in the veins of the spleen, bladder, kidneys, and mesentery. According to Bilharz, at least fifty per cent of the lower classes in Egypt are infected with it. It is not yet known how the parasite gains entrance to the body. In all probability it is by drinking impure water containing the embryos.

The symptoms are due to changes in the mucous membrane of the urinary organs caused by the presence of the parasites in the blood-vessels of these parts. Hæmaturia is the first and most constant symptom, leading gradually to anæmia. There is generally pain during micturition. The blood is not constant in the urine. The ova of the Bilharzia are readily seen under a microscope with a low power. They are ovoid in shape, translucent, with a small spike at one end. The embryo can be readily seen.

The disease is rarely fatal; a great majority of the cases recover. Chil-

dren are more commonly attacked than grown persons, and the disease often disappears by the time of puberty.

(3) *Bronchial Fluke; Distoma Ringeri; Parasitic Hæmoptysis*.—In parts of China, Japan, and Formosa there is an epidemic disease, described by Ringer and Manson, characterized by attacks of cough and hæmoptysis associated with the presence of a small fluke in the bronchial tubes.

III. DISEASES CAUSED BY NEMATODES.

I. ASCARIASIS.

(a) *Ascaris lumbricoides*, the most common human parasite, is found chiefly in children. The female is from seven to twelve inches in length, the male from four to eight inches. The worm is cylindrical, pointed at both ends, and has a yellowish-brown, sometimes a slightly reddish color. Four longitudinal bands can be seen, and it is striated transversely. The ova, which are sometimes found in large numbers in the feces, are small, brownish-red in color, elliptical, and have a very thick covering. They measure .075 millimetre in length and .058 millimetre in width. They develop outside the body, but the life history is not known. The parasite occupies the upper portion of the small intestine. Usually not more than one or two are present, but occasionally they occur in enormous numbers. The migrations are peculiar. They may pass into the stomach, from which they may be ejected by vomiting, or they may crawl up the œsophagus and enter the pharynx, from which they may be withdrawn. A child, under my care in the small-pox department of the General Hospital, during convalescence, withdrew in this way more than thirty round worms within a few weeks. In other instances the worm passes into the larynx, and has been known to cause fatal asphyxia, or passing into the trachea, to cause gangrene of the lung. They may pass into the Eustachian tube and appear at the external meatus. The most serious migration is into the bile-duct. There is a specimen in the Wistar-Horner Museum of the University of Pennsylvania in which not only the common duct, but also the main branches throughout the liver are enormously distended and packed with numerous round worms. The bowel may be perforated by them and peritonitis result.

The symptoms are not definite. When a few are present they may be passed without causing disturbance. In children there are irritative symptoms usually attributed to worms, such as restlessness, irritability, picking at the nose, grinding of the teeth, twitchings, or convulsions. These symptoms may be marked in very nervous children.

Treatment.—Santonin can be given, mixed with sugar, in doses of from one to three grains for a child and three to five grains for an adult, followed by a calomel or a saline purge. The dose may be given for

three or four days. An unpleasant consequence which sometimes follows the administration of this drug is xanthopsia or yellow vision.

(b) *Oxyuris Vermicularis* (*Thread-worm*; *Pin-worm*).—This common parasite occupies the rectum and colon. The male measures about four millimetres in length, the female about ten millimetres. They produce great irritation and itching, particularly at night, symptoms which become intensely aggravated by the nocturnal migration of the parasites.

The patients become extremely restless and irritable, the sleep is often disturbed, and there may be loss of appetite and anæmia. Though most common in children the parasite occurs at all ages.

The worm is readily detected in the fæces. Infection probably takes place through the water or possibly through salads, such as lettuces and cresses. A person the subject of the worms passes ova in large numbers in the fæces, and the possibility of reinfection must be scrupulously guarded against.

The treatment is simple, though occasionally there are instances in which all forms of medication are resisted. A case is mentioned of a gentleman, aged forty, who had suffered from childhood and had failed to obtain any benefit from prolonged treatment by many helminthologists. Santonin may be used in small doses, and mild purgatives, particularly rhubarb. Large injections containing carbolic acid, vinegar, quassia, aloes, or turpentine may be employed. In children the use of cold injections of strong salt and water is usually efficacious. They should be repeated for at least ten days. In giving the injection care should be taken to have the hips well elevated so that the fluid can be retained as long as possible. For the intense itching and irritation at night vaseline may be freely used or belladonna ointment.

II. TRICHINIASIS.

The trichina spiralis in its adult condition lives in the small intestine. The disease is produced by the embryos, which pass from the intestines and reach the voluntary muscles, where they finally become encapsulated—muscle trichinæ. It is in the migration of the embryos that the group of symptoms known as trichiniasis is produced.

Description of the Parasites.—(a) Adult or intestinal form. The female measures from three to four millimetres; the male, 1.5 millimetre, and has two little projections from the hinder end.

(b) The embryo or muscle trichina is from 0.6 to one millimetre in length and lies coiled in an ovoid capsule, which is at first translucent, but subsequently opaque and infiltrated with lime salts. The worm presents a pointed head and a somewhat rounded tail.

When flesh containing the trichinæ is eaten by man or by any animal in which the development can take place, the capsules are digested and the trichinæ set free. They pass into the small intestine, and about

the third day attain their full growth and become sexually mature. Virchow's experiments have shown that on the sixth or seventh day the embryos are fully developed. The young produced by each female trichina have been estimated at several hundred. Leukart thinks that various broods are developed in succession, and that as many as a thousand embryos may be produced by a single worm. The time from the ingestion of the flesh containing the muscle trichinæ to the development of the brood of embryos in the intestines is from seven to nine days. As soon as born the embryo trichinæ leave the intestines; wandering through the peritonæum and the connective tissues, probably through the mesentery and retroperitoneal tissues—some hold by means of the blood current—they finally reach the muscles, which constitute "the seat of election." After a preliminary migration in the intermuscular connective tissue they penetrate the primitive muscle fibres, and in about two weeks develop into the full-grown muscle form. In this process an interstitial myositis is excited and gradually an ovoid capsule develops about the parasite. Two, occasionally three or four, worms may be seen within a single capsule. This process of encapsulation has been estimated to take about six weeks. Within the muscles the parasites do not undergo further development. Gradually the capsule becomes thicker, and ultimately lime salts are deposited within it. This change may take place in man within four or five months. In the hog it may be deferred for many years. The calcification renders the cyst visible, and since first seen by Tiedemann, in 1822, and Hilton, in 1832, these small, opaque, oat-shaped bodies have been familiar objects to demonstrators of normal and morbid anatomy. The trichinæ may live within the muscles for an indefinite period. They have been found alive and capable of developing as late as twenty or even twenty-five years after their entrance into the system. In many instances, however, the worms are completely calcified. The trichina occurs in swine, in the rat, occasionally in mice and cats; it has been found also in the fox and a few other animals. The parasite was first found in the hog by the late Joseph Leidy. Experimentally, guinea-pigs and rabbits are readily infected by feeding them with muscle containing the larval form. Dogs are infected with difficulty; cats more readily. Experimentally, animals sometimes die of the disease if large numbers of the parasites have been eaten. In the hog the trichinæ, like the cysticerci, cause few if any symptoms. An animal the muscles of which are swarming with living trichinæ may be well nourished and healthy-looking. An important point also is the fact that in the hog the capsule does not readily become calcified, so that the parasites are not visible as in the human muscles. For a long time the trichina was looked upon as a pathological curiosity, but in 1860 Zenker discovered in a girl in the Dresden Hospital who had symptoms of typhoid fever both the intestinal and the muscle forms of the trichinæ, since which time the disease has been thoroughly studied.