

muscular strength. One case in the Hedersleben epidemic was weak eight years after the attack.

Of 72 fatal cases in the Hedersleben epidemic the greatest mortality occurred in the fourth and fifth and sixth weeks; namely, 52 cases. Two died in the second week with severe choleraic symptoms.

The mortality has ranged in different outbreaks from one or two per cent to thirty per cent. In the Hedersleben epidemic 101 persons died. Among the 456 cases reported in this country there were 122 deaths.

The *anatomical changes* are chiefly in the voluntary muscles. In the early stages they look normal, but in the fourth or fifth week grayish-white areas appear in which the muscle fibres are extensively degenerated and in the neighborhood of the trichinae there is an acute interstitial myositis. Cohnheim has described a fatty degeneration of the liver and enlargement of the mesenteric glands. At the time of death in the fourth or fifth week or later the adult trichinae are still found in the intestines.

The *prognosis* depends much upon the quantity of infected meat which has been eaten and the number of trichinae which mature in the intestines. In children the outlook is more favorable. Early diarrhoea and moderately intense gastro-intestinal symptoms are, as a rule, more favorable than constipation.

**Diagnosis.**—This is perfectly clear when a large number of persons are infected at once and the parasites have been found in the ham or sausages. The worms may be discovered in the stools. The stools should be spread on a glass plate or black background and examined with a low-power lens, when the trichinae are seen as small, glistening, silvery threads. In doubtful cases the diagnosis may be made by the removal of a small fragment of muscle. A special harpoon has been devised for this purpose by means of which a small portion of the biceps or of the pectoral muscle may be readily removed. Under cocaine anaesthesia an incision may be made and a small fragment removed. The disease may be mistaken for acute rheumatism, particularly as the pains are so severe on movement, but there is no special swelling of the joints. The tenderness is in the muscles both on pressure and on movement. The intensity of the gastro-intestinal symptoms in some cases has led to the diagnosis of cholera. Many of the former epidemics were doubtless described as typhoid fever, which the severer cases, owing to the prolonged fever, the sweats, the delirium, dry tongue, and gastro-intestinal symptoms, somewhat resemble. The pains in the muscles, swelling, oedema, and shortness of breath are the most important diagnostic points. Under acute myositis reference has already been made to the cases which closely resemble trichiniasis. The epidemic in 1879 on board the training ship Cornwall presented symptoms similar to those of trichiniasis. One patient died. Two months after burial the body was examined, and living and dead nematode worms were found which, as Bastian showed, were not the trichina, but a rhabditis.

They were probably not parasitic, but entered the body of the cadet after burial.

**Prophylaxis.**—It is not definitely known how swine become diseased. It has been thought that they are infected from rats about slaughter-houses, but it is just as reasonable to believe that the rats are infected by eating portions of the trichinous flesh of swine. The swine should, as far as possible, be grain-fed, and not, as is so common, allowed to eat offal. The most satisfactory prophylaxis is the complete cooking of pork and sausages, and to this custom in England, France, South Germany, and particularly in this country, immunity is largely due.

**Treatment.**—If it has been discovered within twenty-four or thirty-six hours that a large number of persons have eaten infected meat, the indications are to thoroughly evacuate the gastro-intestinal canal. Purgatives of rhubarb and senna may be given, or an occasional dose of calomel. Glycerin has been recommended in large doses in order that by passing into the intestines it may by its hygroscopic properties destroy the worm. Male-fern, kamala, santonin, and thymol have all been recommended in this stage. There is no doubt that diarrhoea in the first week or ten days of the infection is distinctly favorable. The indications in the stage of invasion are to relieve the pains, to secure sleep, and to support the patient's strength. There are no medicines which have any influence upon the embryos in their migration through the muscles.

### III. ANCHYLOSTOMIASIS.

The *dochmius* or *strongylus duodenalis*, also known as the *sclerostomum* or *anchylostomum duodenale* is the only strongyle harmful to man. It belongs to the same family as the *strongylus armatus*, which causes the verminous aneurism in the horse. The parasites live in the upper portion of the small intestine, chiefly in the jejunum. They are easily seen, the male having a length of from six to ten millimetres, and the female from ten to eighteen millimetres. The mouth is provided with a series of tooth-like hooks, by means of which the parasite attaches itself to the mucous membrane. The male has a prominent expansion or bursa at the tail end. The existence of the parasite has long been known, but it was not thought to be pathogenic until Griesinger demonstrated its association with the Egyptian chlorosis. It has also been shown to be the cause of the anaemia to which miners and brick-makers are subject. Throughout Europe the disease has been widely spread by the employment of Italian and Polish laborers. In certain Italian provinces it is extremely prevalent and serious. It occurs in India and in Brazil, and has been described in Jamaica (Strachan). Dolley states that the parasite was described many years ago by physicians in the Southern States, but no recent observations upon the disease have been made in this country.

**Symptoms.**—The parasites withdraw blood by suction, and the



symptoms result from this slow depletion. In the early stage there may only be gastric or gastro-intestinal disturbance, but if the parasites are present in large numbers anæmia is gradually produced and constitutes the characteristic feature of the disease. The Egyptian chlorosis, brick-maker's anæmia, tunnel anæmia, miner's cachexia, and mountain anæmia are due to this cause. The clinical course is variable. In some instances the anæmia develops acutely and reaches a high grade within a short time, causing great shortness of breath and œdema. There is serious disturbance of nutrition, sometimes diarrhœa and colicky pains; but the most pronounced symptom is the pallor and the associated phenomena of chronic anæmia. The lesions of the intestines are those of chronic catarrh, and small hæmorrhages occur in the mucosa. Dilatation and hypertrophy of the heart have been found in many cases.

The diagnosis is not difficult. The ova, which are abundant in the stools, are oval, about .05 millimetre in length, and possess a thin, transparent shell. There is no operculum, as in the ovum of the oxyuris, and the yolk is unsegmented. The larvæ develop in moist earth and readily get into the drinking water, through which infection occurs.

The systematic use of latrines and the boiling of all water used for drinking purposes are the important prophylactic measures. The treatment should be directed to the destruction of the parasites in the intestine, which may be effected by the male fern or by thymol, which Sansino recommends highly. It is given in capsules of half a drachm every hour for four doses. A purgative is not necessary.

#### IV. FILARIASIS.

Under this term may be considered the morbid conditions induced by the *filaria sanguinis hominis*, or the *filaria Bancrofti*, the name employed to designate the adult worm, which was discovered by Bancroft, of Brisbane. In the adult form the worm lives in the lymphatics. The female is thus described by Patrick Manson, whose studies on this parasite have been so important: "A long, slender, hair-like animal quite three inches in length but only one one hundredth inch in breadth, of an opaline appearance, looking, as it lies in the tissues, like a delicate thread of catgut animated and wriggling. A narrow alimentary canal runs from the simple club-like head to within a short distance of the tail, the remainder of the body being almost entirely occupied by the reproductive organs. The vagina opens about one twenty-fifth of an inch from the head; it is very short, and bifurcates into two uterine horns, which, stuffed with embryos in all stages of development, run backward nearly to the tail." The male worm is much smaller and has only occasionally been found. The female produces an extraordinary number of embryos, which enter the blood current through the lymphatics. Each embryo is within its shell, which is elongated, scarcely perceptible, and in no way impedes the movements.

They are about the ninetieth part of an inch in length and the diameter of a red blood-corpuscle in thickness, so that they readily pass through the capillaries. They move with the greatest activity and form very striking and readily recognized objects in a blood-drop under the microscope. A remarkable feature is the periodicity in the occurrence of the embryos in the blood. In the daytime they are almost or entirely absent, whereas at night, in typical cases, they are present in large numbers. If, however, as Stephen Mackenzie has shown, the patient, reversing his habits, sleeps during the day, the periodicity is reversed. The further development of the embryos appears to be associated with the mosquito, which at night sucks the blood and in this way frees them from the body. Some slight development takes place within the body of the mosquito, and it is probable that the embryos are set free in the water after the death of the host. The further development is not known, but it is probably in drinking water. The filariæ may be present in the body without causing any symptoms. In animals blood filariæ are very common and rarely cause inconvenience. It is only when the adult worms or the ova block the lymph channels that certain definite symptoms occur. Manson suggests that it is the ova (prematurely discharged), which are considerably shorter and thicker than the full-grown embryos, which block the lymph channels and produce the conditions of hæmatochyluria, elephantiasis, and lymph-scrotum.

The parasite is widely distributed, particularly in tropical and sub-tropical countries. Guitéras has shown that the disease prevails extensively in the Southern States, and since his paper appeared contributions have been made by Matas, of New Orleans, Mastin, of Mobile, and De Saussure, of Charleston.

The effects produced may be described under the above-mentioned conditions.

(a) *Hæmatochyluria*.—Without any external manifestations, and in many cases without special disturbance of health, the subject from time to time passes urine of an opaque white, milky appearance, or bloody, or a chylous fluid which on settling shows a slightly reddish clot. The urine may be normal in quantity or increased. The condition is usually intermittent, and the patient may pass normal urine for weeks or months at a time. Microscopically, the chylous urine contains minute molecular fat granules, usually red blood-corpuscles in various amounts. It was in urine of this kind that Wucherer, of Bahia, first detected the filarian embryos. It is remarkable for how long the condition may persist without serious impairment of the health. A patient, sent to me by Dawson, of Charleston, has had hæmatochyluria intermittently for eighteen years. The only inconvenience has been in the passage of the blood-clots which collect in the bladder. At times he has also uneasy sensations in the lumbar region. The embryos are present in his blood at night in large numbers. Chyluria is not always due to the filaria. The non-parasitic form of the disease has already been considered.