INVASION OF THE WALL OF THE INTESTINE BY TRICHOMONAS HOMINIS[1]

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The question of the effects, if any, upon the host of the presence of *Trichomonas hominis* in the human intestine is still a subject of question and debate.

Observations of actual invasion of the wall of the intestine or of its presence beyond the intestine whereby it may be assumed to have escaped from its habitat in the lumen are very rare.

Wenyon (1920) studied 5 cases of *Trichomonas* infection by examining the intestinal content for the flagellates and searching Zenker fixed sections of the wall of the infested portions for them. In none of these cases (in all of which death was due to pneumonia) was there any noticeable lesion which one could attribute to the flagellates.

Histological sections showed the trichomonads to be distributed over the surface of the mucosa. The flagellates were also found in the lumen of the glands of Lieberkuehn, in large numbers in some. In 1 of the 5 cases the organisms were found in particularly large numbers within the glands and careful study revealed that they were apparently passing through definite ruptures in the gland epithelium and were scattered about in the interglandular loose tissues, so that there was a definite invasion of the tissues of the gut. This invasion was general, in sections from the upper large gut and caecum. There never appeared to be any invasion beyond the mucous layer and there was no cellular invasion or proliferation in response to their presence.

Wenyon was inclined to believe that this invasion was ante-

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mortem on account of the absence of such a state in the other cases, in which there was no reason why it should not have occurred if it were a post-mortem development.

This is apparently the only recorded observation of invasion of the tissues of the intestine of the human being although its escape through the circulation is indicated by the observations of Pentimalli (1923), who found *Trichomonas* in the circulating blood on two occasions in the same patient, and of Kessel (1925), who found this organism in the pus of an amoebic abscess of the liver.

The kindred flagellate (*T. caviae*) of the intestine of the guinea pig often invades the tissues of the wall, which shows ulceration, according to Wenyon (1926).

For its possible bearing on the question of tissue invasion by *Trichomonas*, the following study and observations are presented. The material comes from a case referred by Dr. A. E. Baker, Jr., Charleston, S. C.

The subject was a white women, forty-seven years of age, in good physical state at the time of entrance to the hospital for the purpose of having a cauterization of an eroded cervix uteri, the extraction of two infected teeth, and the removal of two tabs of external hemorrhoids by clamp and cautery.

These operations were done under a single anaesthesia, from which the patient reacted well. On the second day she suddenly developed a violent diarrhoea, with high fever, abdominal tenderness and pain, and a septic state from which she died twelve days later. During this course she had frequent liquid purulent stools. A specimen of this stool was sent to me a few days before her death. It was a thick yellowish-grey liquid containing enormous numbers of *Trichomonas hominis* in an active state of multiplication. There were many flagellates of about half the ordinary size and there were many large forms in a state of division. In the stool were, also, numerous leucocytes, red blood corpuscles, and *Blastocystis*.

Immediately after death of the patient occurred Dr. Baker did a post-mortem examination, removing the transverse colon and placing it directly in 10 per cent formaldehyde. This imme-

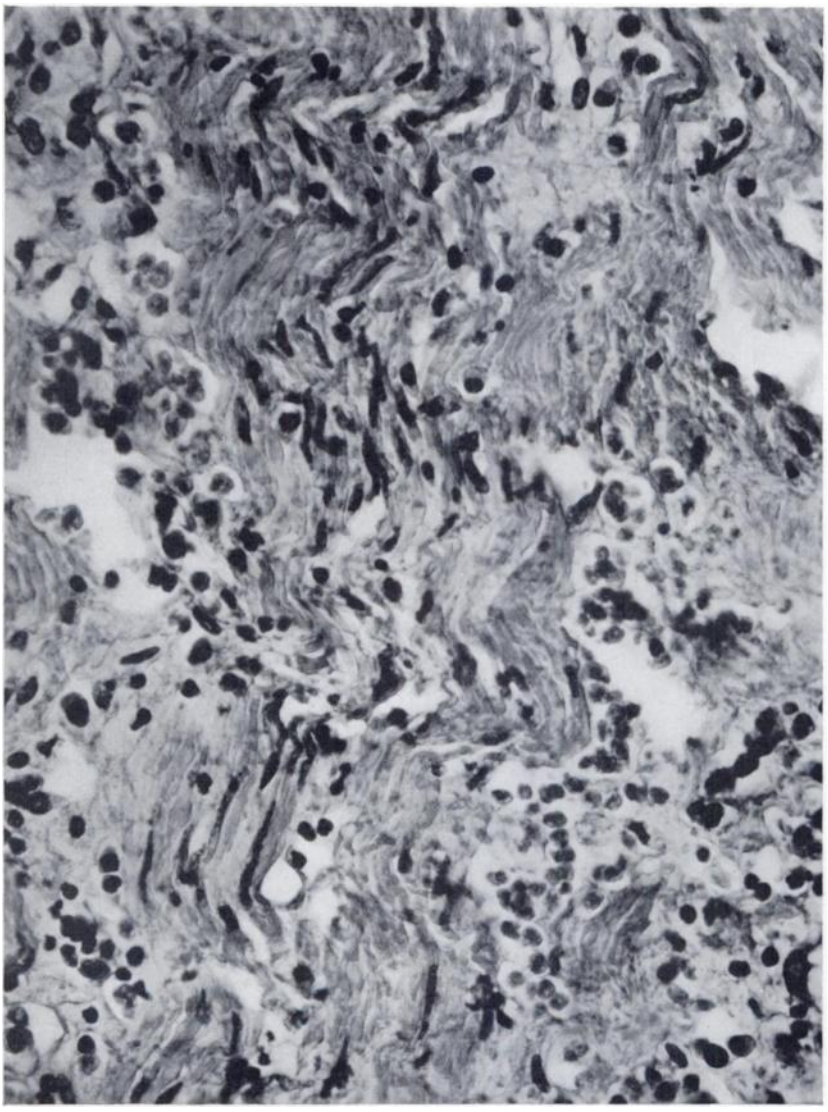

FIG. 1. PENETRATION OF *Trichomonias hominis* INTO MUSCULAR COAT OF THE COLON. × 760

diate autopsy and fixation of the colon made possible the study of *Trichomonas* in histological sections. No doubt Zenker fixation would be better but early post-mortem fixation of the tissue is necessary if one wishes to make a study of this organism in its relations to the intestine wall. Most post-mortem material is unsuitable because the time between death and post-mortem examination is usually sufficient to render observations unreliable, either by allowing the organisms to escape their natural bounds or in causing their death and disintegration.

It appeared at this autopsy that the transverse colon only was involved in virtually a gangrenous state and that there was a rupture of this colon with peritonitis.

The fixed section (No. 11775) which I received was of about 6 inches of the colon. The whole mucosa was in a state of hemorrhagic, ulcerated, pseudomembranous necrosis. In the depressions the ulcerations extended deeply and only a paper-thin peritoneal coat prevented actual perforation in many places. There were two ragged tears, one probably the rupture.

It was thought that the gangrenous inflammation of this transverse colon was probably due to mesenteric thrombo-phlebitis, but this is not entirely beyond question. No bacteriological studies were made. It is interesting that the patient had a history of a previous attack of mesenteric thrombosis, so diagnosed, from which she had recovered some months or more ago.

In histological sections of this colon, stained by hematoxylin and eosin, the mucosa is entirely necrotic. Necrosis extends irregularly to include much of the submucosa and dips into the muscle coats and even through them at places. There is a zone of necrotic decomposing tissue covering the whole of the inner surface. The wall of the intestine below the necrosis is the seat of diffuse inflammation, with leucocytosis, monocytosis, lymphocytosis, fibroblast proliferation, hyperemia, hemorrhage, oedema, fibrin deposit, and extensive thrombosis of bloodvessels, particularly the smaller veins.

In the necrotic lining may be seen scattered trichomonads. In the immediate zone of living tissue of submucosa below the necrosis where leucocytosis is prominent there is no apparent invasion

of *Trichomonas*. Scattered trichomonads and occasionally a group or colony may be seen in the intercellular spaces of the fringes of this tissue. Where the necrotic depressions or sinuses extend deep into the wall, however, more particularly when they penetrate the inner musculature, commonly there occurs a definite colony within the depth of the pocket with infiltration of the flagellates into the spaces of the edge of the living tissues. From these foci there occurs conspicuous penetration of the trichomonads into the muscle, the flagellates lying in groups and columnar colonies between the bands of muscle fibers. Immediately adjacent to the invaders the muscle fibers show some globular hyaline cytoplasmic degeneration and fragmentation but this change is also seen where there are no trichomonads. Where the flagellate colonies occur there is no leucocytosis, where cellular disintegration and leucocytosis are seen there are no trichomonads. This penetration beyond the necrotic zone and into viable tissue varies in different foci but is commonly for the distance of one-half or more of the width of the inner muscle coat.

The trichomonads scattered in the necrotic lining of the inner surface, in groups in the fringes of living submucosa, and in these intramuscular colonies, are of unquestionable identity.

In the ordinary paraffin section, cut at six microns, stained with haematoxylin and eosin, they are readily distinguishable from tissue cells and are not to be confused with amoebae, although they are not as distinct in their outlines or nuclear staining as are living tissue cells or amoebae. It would be very easy, however, to mistake them for amoebae. Their relative obscurity and small size would lead to failure of a casual examination to reveal them in all probability. In fact they may readily have been overlooked in these sections except that knowledge of their numbers in the stool of this patient led to special search for them.

It seems clear that they did not invade the living tissues of the denuded surface generally and that where active leucocytosis occurred they did not survive. The favorable location for them was at the depth of necrotic sinuses or pockets, where phagocytic response had not occurred, and within tissue spaces immediately adjacent to such foci, particularly within the muscle, where the

flagellates penetrated for considerable distances, relatively, between the bands of living, although degenerated, muscle.

None could be found within the circulatory channels and they did not penetrate far in the loose connective tissues of the submucosa even when they had entered the zone of living tissue.

Incidentally it may be noted that *Blastocystis*, which occurred in the stool, was not seen in these sections.

It is not probable that *Trichomonas* had any part in the initiation or development of any part of the necrosis or inflammation of this intestine. The appearances were all to the effect that the organism had been given an excellent culture medium in the exudate into the intestine and that it had multiplied to enormous numbers.

Invading the recesses of the necrotic lining of the bowel it had found conditions favorable for its growth in the fringes of the dying tissue and at the depths of necrotic pockets. It is significant that where active leucocytosis existed these organisms were not present. The remarkable feature of the actual tissue invasion was the favor which they found within the living muscle. They had apparently found a favorable medium and had been able to migrate along the intermuscular septa. This is, of course, taking it for granted that invasion took place before the death of the host. That may not be certain but it is made probable by the extent of penetration of the muscle and by the early time of autopsy and fixation of the section of the colon.

Assuming that the penetration of the flagellates occurred during the life of the host, their ability to penetrate the tissues with which they would be most apt to come into contact in the usual abrasive lesion of the intestine, i.e., the loose tissues of the mucosa and submucosa, is not impressive. They exhibited no penetrative qualities comparable to *Endamoeba histolytica*, for instance. It was not until they were brought into direct contact with the muscle coat by the extension of the necrosis that they found a favorable avenue for migration, apparently along the intermuscular septa. This infiltration resembled the similar occurrence in intestinal amoebiasis when *Endamoeba histolytica* may invade the muscle coats.

Of course, in such a case as this, of virtual gangrene of the intestine, the entrance of *Trichomonas* into the wall of the bowel would probably be of no significance in the course of events.

However, it is taken to be of significance in the question of the possible effects of *Trichomonas hominis* on its host that in this case where the opportunity for its invasion was apparently as good as could be desired it succeeded in doing so only in a manner which indicated very material limitations and which appeared to excite no response, in itself, from the tissues invaded.

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