AMOEBIASIS IN THE UNITED STATES

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In considering amoebiasis as a public health measure, perhaps it would be best first to consider the organism, the pathology and clinical findings briefly, which are present in the above named condition.

ORGANISM The organism which we are dealing with in this case is Enta-amoeba Histolytica which is a protozoan organism, and belongs to the phylum Rhizopoeda, to which also belong the four genera (1) Entamoeba (a) E. Histolytica and E. Coli, (2) Endolimax (a) E. nana, (3) Iodomoeba, (4) Dientamoeba, the last two having but a single species, I. Butschlii and D. Fragilis, respectively. Of these organisms we need only be concerned with E. Histolytica and E. Coli, and the latter only insofar as differential diagnosis is concerned. However, other forms should be kept in mind as when doing a stool examination they are likely to lead to gross errors in diagnosis.

The classic description of E. Histolytica is as follows: E. Histolytica is 20 to 30 U. in diameter when rounded and at rest. Their endoplasm is colourless, finely granular and uniform in appearance; their ectoplasm clear and well developed. The single nucleus is a delicate vesicle, inconspicuous or invisible during life. When carefully fixed and stained it is seen to have the following structure: The nucleus membrane, which is very thin and achromatic, is lined internally with a layer of fine chromatin granules usually in contact with one another. They are usually nearly equal in size, so that the nucleus appears in optical section as a finely beaded ring. At the center of the nucleus there is a small structure, the karysome which consists of two parts, an inner granule or a tiny sphere of chromatin, surrounded by a clear achromatic zone. In the stained nucleus, an achromatic network free from chromatin granules, fills up the space between the karysome and the peripheral layer of beads. The nucleus as a whole usually measures from 4 U. to 7 U. in diameter, according to the size of the organism.

The chromatic part of the karysome has a diameter of about 0.5 U. or slightly less but seldom attains the size of 1 U. The mode of nutrition is peculiar in this species, it being mainly by absorption, and not by free ingestion of food as in the free-living amoeba. Solid food, however, is at times ingested, but such food is of a peculiar nature. It consists entirely of R.B.C. and more rarely of fragments of tissue cells of the host. R.B.C. are sometimes seen in large numbers, in various stages of digestion, in the endoplasm, more than a score being present sometimes, and these inclusions give the organism a very peculiar and characteristic appearance. The movements are also very characteristic, and in a suitable media and at suitable temperature they exhibit astounding activity. It goes, or rather flows, almost in a straight line across the field of the microscope, and in extended form suggests a slug moving at express speed. In this condition the anterior end consists of a single large pseudopoedium, advancing so rapidly that no sharp line can be seen separating the ectoplasm from

the endoplasm. The R.B.C. within, flow with the organism as though the protoplasm were a mobile liquid. The rapid locomotion seldom persists for a very long time outside the body. The animalicule finally rounds up, ceases to move, and dies. No similar movement is performed by any other intestinal parasite in man.

Reproduction is by simple fission. Encystation takes place in the gut of the host as follows: The active forms pass from the tissues into the lumen of the gut and there undergo one or more divisions, leading to decrease in size, the size eventually obtained by the daughter amoebae being proportioned to the size of the cysts which they are to form. At the same time they get rid of the R.B.C. As a result, peculiar small amoebae with a very clear protoplasm are formed. These are the "precystic forms." The precysts are converted into cysts by a simple process of hardening or rounding up into a small ball of protoplasm, and secreting a delicate and transparent capsule or cyst wall around itself. The cysts are about 7 U. to 15 U. in diameter. They never contain more than four nuclei, have chromatoid bodies, and glyeogen vacolis. The forms of E. Histolytica active are distinguished from E. Coli by the latter's lack of mobility, greater size, great amount of cell detritis, lack of R.B.C., clear ectoplasm. The cysts by the lack of vacuoles, greater size, and also having 8 or more nuclei.

It is clear, no doubt, that E. Histolytica being a tissue absorbing parasite must produce lesions which would result in more or less damage to the lumen of the gut of the host. The amount they produce is dependent on the virulence of the strain, the resistance of the host, and his capability of regeneration of the gut lumen. When the host is capable of keeping up an equilibrium of regeneration, this is considered as "normal amoebiasis." When the host and parasite do not live in harmony two patholigical conditions result.

1. Primary or intestinal disorder -- This consists of a long standing persistent dysentery of typical character.
2. Secondary disorders among which are:
   1. Liver abscess
   2. Amoebic Hepatitis
   3. Pulmonary abscess
   4. Diaphragmatic abscess
   5. Cerebral abscess
   6. Uterine abscess
   7. Phagedena skin ulcers
   8. Amoebic cystitis

Indirectly:
1. Hodkins disease
2. Atrophic arthritis of nicoli
3. Carcinoma - ?

There is no doubt that amoebiasis is much more prevalent in Oriental countries than Occidental and much more so in the

tropics than in the temperate zone, but however this does not mean at all that amoebiasis is not a public health issue in the temperate zone, because heretofore much of the amoebic infections in this country and England have been masked due to improper clinical as well as laboratory diagnosis. It is a shame that in this country so little attention is paid to the study of parasites in the schools of medicine.

It was noted that many of our troops coming home from the Philippine islands were suffering from a strange dysentery which would not respond to any known treatment at that time. It remained for Colonel Craig to solve this problem, although amoebic dysentery had run riot and was known before. It was Craig who diagnosed these conditions in our armies returning from the Philippines. Stitt also recognized this condition in some of the foreign service troops, and called the War Department's attention to the same. But it remained for the World War to bring to the fore the real significance and danger of the disease. It was in this work that Prof. Kofoid, Dr. Boeck and Dr. Olive Swezy gave a lasting contribution to the science of medicine and public health measures. Dobell in England did similar work, probably a little more extensive and complete as he had more material to work upon.

It was noted that the troops in the Gallipoli and Mesopotamia of B.E.F. were suffering with a strange persistent diarrhea and many were invalided home from these infections. It incapacitated many men from active duty on the firing line, and it was at this stage of the game that Dr. Dobell was asked by the British Government to make a survey of the soldiers suffering with dysentery in home and foreign service. He undertook this study in a most astounding and thoroughly scientific way. The results, after many months hard work, were published and the results fairly astounded the scientific world. Certain contingents returning from the Gallipoli, Palestine, and the Mesopotamian fronts showed an incidence of infection as follows:

		E. Hist.	Carriers	E. Coli
Gallipoli	2800 with dysentery	8%	37%	56%
Mesopotamia	2500 with dysentery	8.6%	32.5%	54.5%

The men returning from France examined, for example, from a certain contingent, give the following results:

	E. Hist.	Carriers	E. Coli
Group A 5,200 with dysentery	2.3%	16.4%	24.6%
Group B 2,500 with dysentery	4.6%	16.4%	26.4%

These above figures awoke the British Public Health officials to the severity of the amoebic infections and also to the fact that they were much more common than hitherto supposed to be.

Then Dr. Kofoid, the eminent protozoologist, made surveys

on a group of soldiers in this country, the one group being of soldiers in foreign service and the other being of soldiers who saw only service on this side of the ocean. His results are as follows: Of 2,144 men in foreign service, 276 were infected with E. Histolytica or approximately 19.9%, and of home troops, 559 cases were examined by Kofoid and 22 infections were revealed, making this percentage 3.9%. Group B, shown as follows: Home Service, 4.9%; Foreign service, 12.8%. Many of these, however, were carriers and not active cases. If, however, 12.8% of 3,000,000 men overseas became infected, there would be approximately 384,000 such carriers or 768,000 if twice this percentage were infected. Thus we see amoebiasis is now a question which cannot be looked up as a rare condition.

The average number of cysts discharged by the average carrier per diem is 330,000 to 45,000,000, or averaging 14,520,000 per day, and when one realizes that the average of amoebiasis carrier conditions in the United States is 8.8% of the entire population, the average number of cysts deposited daily would be roughly 14,520,000,000,000,000,000. Now, one can conceive of the great possibility of infection of this disease and also great number of difficulties one would have to meet with in controlling this disease. The localities in this country where it would be the greatest problem for Public Health workers would be mostly the southern Atlantic states, southern sea bordering states, and in our own Pacific coast. Oregon has the lowest incidence of amoebiasis of any of the Pacific coast states, California and Washington being the worst offenders.

Having gotten the amoeba out of the body and proven its rather widespread condition, let us now consider the ways it can be spread:

1. By carriers)
2. By contaminated water) Through faecal
3. By contaminated food products) material medium
4. By flies)
5. By mice
6. By frogs
7. By poor sanitation
8. By contact

There is little need here for further explanation as to why this is an important factor in Public Health prophylaxis. Directly or indirectly all these causes above are due to faecal contamination. Let us now consider how it would be possible for a carrier to infect. This probability is much greater in country districts and camps where men are herded together than in the city. Why should the former two factors be the greatest? Because in the country one has privies that are poorly constructed. How, now, could this cause spreading of amoebic infections? The first and probably the most important way is through flies. It has been clearly demonstrated that the average fly, after feeding on an amoebic stool can carry up to 25 cysts at one time. When we observe that every time a fly lights, he leaves the so-called fly speck, it is little wonder that amoebic infections are not more

wide spread than is now. Secondly, the privies are usually near water supply and drain down into them, thus giving another source of infection. Thirdly, by direct contact. Hence, it is easily seen that a carrier depositing his faecies in the open, or in poorly constructed privies, can easily be a source of many other infections.

Food can be infected either through flies, direct contact, or by inumerable other methods. Of the importance of water and fly infections we have already spoken. The rat and frog have also a role in infection, as amoebae have been isolated from them, although Grinell doubts their pathogenicty to man. Poor sanitation speaks for itself, as does direct contact. Some authorities have attempted to say that amoebiasis is air borne but this is not accepted.

Now let us consider what can be done in checking this condition which is fast coming to the fore as a problem which must be dealt with more severely than it has been in the past. Let us consider it from two standpoints--1. Public Health Measures. 2. Personal Hygienic Health Measures. Of course, the first thing for the public health authorities to do would be to run an accurate and far reaching survey as to the incidence of this infection in order to know in what sections of the country to put the most emphasis on their work. After the incidence of the infection has been determined, the next thing to do is to educate the public and the physicians in the locality concerning amoebiasis. In educating the latter mentioned class I mean teaching them how to diagnose amoebic dysentery and also establishing a district laboratory wherein a competent diagnosis on faecal material could be obtained. Thiedly, I would suggest a general improvement in sanitary conditions be made. In this I mean both by the action of the health officials and by individual laiety population themselves. This would involve inspection of food, water, and of privies by the health agents. Also it would involve the establishment of dispensaries such as was established for the treatment of hookworm in which carriers could be diagnosed and treated and where those with active infection could be treated. This former statement as to diagnosis of the carrier in a practical way seems impossible but as far as possible it should be done. The health agents should also teach the individual proper sanitation, and how to construct privies which are fly-proof and sanitary. In seaport towns, all immigrants and sailors should undergo at least 2 stool examinations before allowed to land and if they have either the active or carrier condition, they should be deported.

Now, as to the individual himself, he should be taught better personal sanitation, the way in which to build sanitary privies, and to cook all food and water in a region where this is rife. Now, in concluding, let me say amoebiasis is a condition which is far more serious than formerly thought to be, and demands immediate attention and extermination as far as possible by Public Health measures and by Public Health agents.