DYSENTERY AND ENTERIC DISEASE IN MESOPOTAMIA FROM THE LABORATORY STANDPOINT.

AN ANALYSIS OF LABORATORY DATA DURING THE EIGHTEEN MONTHS ENDING DECEMBER 31, 1918.

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INTRODUCTORY.

The data I have gathered together for analysis and presentation in the following paper represent the work of the bacteriologists in the Mesopotamian area on this subject during the period of my tenure of the post of Consulting Bacteriologist to the Force.

My acquaintance with laboratory conditions in Mesopotamia dated from September, 1916, when I visited the country as a member of the Medical Advisory Committee. This tour lasted about six months, during which I had ample opportunity of making the acquaintance of all the pathologists in the area, of inspecting laboratories, and making suggestions for improved facilities and more satisfactory organization generally.

Dysentery, diarrhoeal diseases, and enterica bulked largely in the area during my first visit and advantage was taken of the autumnal dysentery prevalence in the last quarter of 1916 to suggest the carrying out of an inquiry into the nature of the epidemic, by careful examination of consecutive cases of acute dysentery. The investigation was carried out at No. 3 British General Hospital, Basra, under the superintendence of Captain Boney, R.A.M.C., and the published report (1918) showed clearly the great predominance of the bacillary type in the autumn epidemic of 1916.
On my return to the country in August, 1917, in the capacity of Consulting Bacteriologist to the Force, I very early decided that, if statistical use was to be made of laboratory data collected from a large number of laboratories situated in different parts of the area, one primary essential was the introduction of a return for laboratory findings which would at least ensure the presentation of data in a form capable of yielding comparable information. The question as to how far the accuracy of the statistics based on this form was to be affected by differences in the conscientiousness and reliability of the observers was left to settle itself, but every attempt was made to reduce such differences by such methods as the stereotyping of rules for the diagnosis of Entamoeba histolytica, the classification for laboratory purposes of clinical dysentery types, periodical visits to laboratories, correspondence with workers, and the monthly distribution among all the laboratories of the area, of an analysis of the previous month's data. This latter analysis was prepared by the writer from the laboratory data returned monthly to headquarters and was, I believe, of much assistance to the laboratory workers generally who, otherwise, would have been ignorant of work and findings outside their own area.

Samples of the monthly laboratory form, the ward-laboratory forms, and the rules for guidance are appended, in order to indicate the nature and scope of the basal data on which this survey is founded. During my tenure of the post of Consulting Bacteriologist, the personnel of the laboratories did not alter much, at least in so far as the important first-class laboratories were concerned—a circumstance that conduced to uniformity and continuity of method.

Baghdad, Amara, and Basra had each a Central Laboratory, officered by well-known members of the Bacteriological Department of the Indian Medical Service. At these Central Laboratories the work performed was mostly in connexion with scientific inquiries into prevailing disease, chemical investigations and public health questions, but a certain amount of routine diagnosis involving cultural work was also undertaken on behalf of such hospitals as did not possess full laboratory facilities. All the British General and Stationary hospitals possessed or came to possess first-class laboratories capable of dealing completely with the bacteriological diagnosis of cases. Of the Indian General and Stationary hospitals, two only had facilities for cultural work. The others had to send their material for cultural work either to the nearest first-class laboratory, or, as was most usual, to the nearest central laboratory.

The total number of first and second-class laboratories, including central laboratories, was twenty-six, and they were distributed thus:

**Basra.**—First-class laboratories: 1 Central Laboratory, 3 British general hospitals, 1 officers' hospital, 1 infectious hospital and 1 Indian general hospital. Second-class laboratories (microscopical work mainly): 5 Indian general hospitals.
Nasariyah.—1 first-class laboratory.

Amara.—First-class laboratories: 1 Central Laboratory, 3 British hospitals, and 1 Indian hospital. Second-class: 3 Indian hospitals.

Kut.—First-class laboratories: 1 British hospital. Second-class: 1 Indian hospital.

Baghdad.—First-class: 1 Central Laboratory, 3 British hospitals. Second-class: 2 Indian hospitals.

In addition to the above, certain casualty clearing hospitals provided with facilities for microscopical work gave monthly returns, and during the last quarter of 1918 returns were received from Hamadan and from the large refugee camp at Bakuba whither certain British and Indian hospitals with their laboratories had been drafted for duty.

**Dysentery and Diarrhoea.**

For laboratory purposes, dysentery and diarrhoea cases were divided into two groups according to the character, naked-eye and microscopical, appearances of the motion, viz.: (1) B. and M. group (i.e., blood and mucus) and (2) non-B. and M. group. The laboratory returns for the month yielded the percentage figure for the presence of *E. histolytica* in B. and M. cases, and non-B. and M. cases, and also for the successful isolation of *Bacillus dysenteriae* in cases submitted to cultural examination.

Through the kindness of the headquarters staff, I was enabled to secure official figures for admissions to hospital of dysentery, diarrhoea and "colitis," and also the official strengths, both British and Indian, of the Force generally and its various areas.

An official return of "dysentery" was made or was understood to be made only when the patient was found to be passing blood and mucus. With this group of cases, the laboratory returns in connexion with the presence of *E. histolytica* or *B. dysenteriae* in B. and M. cases were brought into relation. Under "colitis" and "diarrhoea" were officially returned cases of a milder type which were not understood to be passing blood and mucus. Doubtless, many cases returned under these unsatisfactory headings should have been returned as dysentery, but on this point more will be said later. It is sufficient to say here that the laboratory findings in the non-B. and M. cases (as determined by laboratory examination) were, for the purposes of this analysis, brought into relation with the incidence figures for official "colitis" and "diarrhoea."

**Incidence of Dysentery and Diarrheal Disease in British and Indians.**

It is important, in the first instance, to note that the ratio of British to Indian strength in the whole area varied throughout the fifteen months under review from 1 : 2.6 to 1 : 3.

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1 These figures were extracted by myself from files placed at my disposal and are not to be regarded in the light of final official returns.
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In the forward area the ratio remained fairly constant throughout the whole period at 1 : 1.6.

At the base (Basra) the proportion of British was considerably lower and varied throughout the period from 1 : 4.2 to 1 : 5.

The incidence of dysentery (combined British and Indian) throughout the area, from July 1916 to December 1918, is shown in Chart 1, the columns representing incidence per 10,000 per average monthly population. The admissions for the calendar months are obtained by adjustment on a uniform basis of the figures in the "week-ending" files. The columns prior to October 1917 are calculated from the weekly incidence rates for combined B and I dysentery. That the interpolation for months in this latter
Chart 2.—Dysentery: Force, British.
period has been made on a principle not strictly accurate mathematically will not make any material difference to the general course of the dysentery prevalence, which is all that the chart is intended to show. The six months of 1916 show unusually high incidence columns for July and August, when the maxima exceeded those reached in the succeeding autumn epidemics. How far this is accounted for by inaccurate dysentery diagnosis and a loose clinical use of the term "dysentery," thus making the columns represent diarrhoeal group incidence rather than dysentery incidence, I am unable to say. It may be that the spring epidemic of 1916 actually far exceeded in maximal incidence the autumn epidemic of that year which had its maximum in October, while subsequent years showed November maxima. The tall columns for July and August 1916, would therefore represent simply the aftermath of a great spring epidemic. In 1917 and 1918 the spring and autumn epidemics have their maxima in May and November respectively, and the epidemic-free months are in both cases February and March. In these latter months the incidence is minimal. The third quarter of the year assumes either a plateau-like character with an incidence never falling below that of April, the first month of the spring epidemic, or a gradual staircase form leading up to the autumn outbreak.

Charts 2 and 3 (complete columns) show the monthly incidence per 10,000 strength of dysentery in British and Indians respectively from October 1917 to December 1918. In both charts the general course of the dysentery prevalence is similar but there are one or two marked differences apart from the enormous difference quantitatively in the respective incidences. In the British chart (Chart 2), the spring and autumn epidemics are more clearly cut. Further, while the third quarter dysentery aftermath in the British chart is seen to be composed of the termination of the spring outbreak and the first stage of the autumn outbreak with a
CHART 4.—Dysentery (Forward area), British.

CHART 5.—Dysentery (Forward area), Indians.
minimum in August, the Indian aftermath shows a secondary rise in August and the autumn outbreak appears to start later (in October instead of September as in British).

The following figures show the incidence variations in British and Indian:

- Minimal incidence in British (February): \(10.9\) per 10,000
- Minimal incidence in Indians (February): \(5.6\)
- Maximal incidence in spring outbreak in British (May): \(59.6\)
- Maximal incidence in spring outbreak in Indians (May): \(17.2\)
- Maximal incidence in autumn outbreak in British (November): \(85.3\)
- Maximal incidence in autumn outbreak in Indians (November): \(21.9\)

The minimal February incidences and the two maximal incidences are thus connected in British and Indians:

British: as \(1 : 5.4 : 7.8\); Indian: as \(1 : 3 : 3.9\), and as \(5.4 : 7.8 : 1 : 1.4\) and \(3 : 3.9 : 1 : 1.3\), it will be seen that the British and Indian maxima in the autumn epidemic bear practically the same quantitative relation to their corresponding spring maxima.

The charts for the Forward area should theoretically provide the best indication of the general course of dysentery prevalence in a fighting force as the population of the Forward area is a homogeneous one and the environment, sanitary and otherwise, is more or less stereotyped.
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CHART 7.—Dysentery (Baghdad), British.

CHART 8.—Dysentery (Baghdad), Indians.
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In the British chart the spring outbreak is very clear cut and the months of July and August form a true plateau with a level slightly below that of April. The autumn epidemic starts abruptly in September.

The Indian chart (No. 5) is somewhat puzzling. Here the curious increased prevalence or secondary epidemic in August is quite marked and the spring outbreak is small in comparison with it. In fact, there would appear to be three epidemic periods or periods of increased prevalence in Indian dysentery of the Forward area, as compared with only two in the British. Different factors which I am unable to suggest at present must be at work in the two cases.

Chart 6 forms part of Chart 1 already referred to. The general course of dysentery prevalence is seen to be determined by the British element.

The British chart (No. 7) has its spring maximum in June, a month later than in the Forward area, while the autumn outbreak starts in October. Otherwise the general course of the Basra and Forward area dysentery is similar. The Indian chart however (No. 8) takes an entirely different form from that of the Indian Forward area. The incidence in March is practically the same as that in October and both are minimal. The intervening prevalence is probably a summation of the usual spring outbreak with maximum in May and the secondary wave with maximum in July. The autumn outbreak occurs as usual though late, but it barely attains the dimensions of the spring-summer wave.

The following figures show the incidence variations in B. and I. in the Forward area and Basra respectively:

<table>
<thead>
<tr>
<th>Area</th>
<th>British</th>
<th>Indian</th>
<th>Forward Area: British</th>
<th>4.6 to 83.9 per 10,000 per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basra</td>
<td>British</td>
<td>10.6 to 75.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian</td>
<td>4.1 to 11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basra</td>
<td>British</td>
<td>2.9 to 31.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian</td>
<td>2.8 to 31.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DYSENTERY, DIARRHEA AND "COLITIS."

These charts start from January 1918, when Diarrhea and "Colitis" were added to the Special Diseases notification list. With regard to the British charts, their general course follows almost exactly that of British dysentery except that the incidence of "Diarrheal Diseases generally would appear to reach a higher maximum value in the spring rather than in the autumn. The Basra Indian chart reflects the character of the Basra Indian dysentery with a prevalence stretching from April to October.

The incidence variations in Diarrheal Diseases are as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>British</th>
<th>Indian</th>
<th>Forward Area: British</th>
<th>10.4 to 197 per 10,000 per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basra</td>
<td>British</td>
<td>8.9 to 75.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian</td>
<td>8.9 to 75.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basra</td>
<td>British</td>
<td>24 to 138</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian</td>
<td>12.4 to 43.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chart 9.—Diarrhoeal diseases (dysentery + colitis + diarrhoea); Force, British.

Chart 10.—Diarrhoeal diseases; Force, Indians.
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Chart 11.—Diarrhoeal diseases; Forward area, British.
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CHART 12.—Diarrhoeal diseases; Forward area, Indians.

CHART 13.—Diarrhoeal diseases; Basra, British.
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Nature of the Dysentery in the Mesopotamian Area.

Returning to the charts already commented upon, attention is drawn to the lower portions of the columns. These represent that amount of the monthly incidence per 10,000 strength, which, according to the laboratory findings, is due to amoebic infection. In the dysentery charts, the basis of the calculation of amoebic incidence is the percentage of E. histolytica in B. and M. cases examined by the laboratories during the month. For the charts dealing with the whole area, the amoebic percentages corresponding to the various months are calculated from the mass results qua E. histolytica in B. and M. cases from all hospitals excluding those dealing with transfer cases mainly. The monthly percentage is then used to calculate the height of that portion of the general incidence column which is directly due to amoebic infection. Similarly in charts dealing with diarrhoeal diseases, the monthly percentage of E. histolytica in all cases, B. and M. and non-B. and M. is employed. As a test of the validity of determining the amoebic incidence per 10,000 strength in this way, let us take the force figures for dysentery, diarrhoea and colitis for the period January to December, 1918.

<table>
<thead>
<tr>
<th>Dysentery</th>
<th>Colitis and Diarrhoea</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.</td>
<td>I.</td>
</tr>
<tr>
<td>5492</td>
<td>4937</td>
</tr>
<tr>
<td>6927</td>
<td>9286</td>
</tr>
</tbody>
</table>

The total notifications were 25,642. During the same period, the total dysentery and diarrhoea cases examined by the laboratories were 24,667. Also Baghdad British laboratories examined 94.8 per cent of the dysentery and diarrhoea notifications in advanced section, while Indian Baghdad laboratories examined 71.6 per cent of the total. With regard to the Forward area, a small proportion of the dysenteries were examined microscopically at certain casualty clearing hospitals, but the results obtained at Baghdad laboratories may be taken as a fairly accurate guide to the nature of the diarrhoeal disease prevalent among the fighting troops.

As there are two main causes of dysentery operating in the area,
(E. histolytica and B. dysenteriae) it is of the greatest importance to ascertain what part each plays in the spring and autumn outbreaks and in the epidemic-free periods. This problem has engaged considerable attention both on the part of bacteriologists and clinicians working on various Eastern war fronts, since the notable outbreak in the Dardanelles in 1915. In that outbreak, both amoebae and B. dysenteriae played a part and while some assigned a greater importance to E. histolytica as the main “epidemic” agent, others inclined to the view that by far the major portion of the dysentery was of bacillary origin. The latter view was more fully substantiated by subsequent investigation in 1916 and, since then, the main epidemic agent of dysentery both in Egypt and in the Salonica area has undoubtedly been B. dysenteriae.

It has to be remembered that in work of this kind the rôle of E. histolytica in a sample of acute dysenteries can be very accurately defined as, in the opinion of most experts, E. histolytica in the vegetative form can be demonstrated by single examination in well over ninety per cent of untreated amoebic dysenteries examined in the early days of the disease. At a later stage the finding of the characteristic cysts clinches the diagnosis. It is otherwise with B. dysenteriae, to isolate which, with reasonable prospect of success, it is important to secure samples at the earliest period of the disease. Moreover, apart from this difficulty, which only good ward-laboratory co-operation can successfully combat, the technical work involved in cultural investigation cannot be compared with the simple microscopical demonstration of a living amoeba. Consequently, quantitative results qua amoebic percentage are by no means strictly comparable with quantitative results qua B. dysenteriae. My own view is—and it agreed with clinical opinion in Baghdad—that in an epidemic season practically all the non-amoebic acute dysenteries may fairly accurately be regarded as bacillary (see later data on this point). The test of the predominance of B. dysenteriae during an epidemic period must be a fall in the percentage of E. histolytica from that reached in the month prior to the epidemic. If the amoebic percentage falls the excess of cases must be due to bacillary infections. If the amoebic percentage remains fairly constant or even rises somewhat, the epidemic may be considered as the resultant of two forces, one of which, however, will always be more prominent than the other, in view of the fact that E. histolytica percentages in B. and M. cases have only in exceptional circumstances exceeded fifty per cent.

(To be continued.)