SALMONELLA SPECIES ISOLATED IN THE MIDDLE EAST

BY

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In the course of routine work at the Army Central Medical Laboratory, Fayid, in the Suez Canal Zone of Egypt, a number of Salmonellae, other than those causing typhoid and paratyphoid fevers, have been isolated and identified. The Salmonellae are all of human origin and were isolated during the years 1950 and 1951. The routine work referred to includes the examination of specimens from cases of gastro-enteritis and diarrhoea, the examination of British and Egyptian cooks for carriage of enteric organisms, and the clearance of patients convalescent from enteric fever.

This report enumerates the Salmonellae which have been isolated and describes the clinical manifestations of the infection together with any bacteriological or serological details that could be ascertained. It also includes several Salmonellae isolated in R.A.F. laboratories and in Army laboratories in other parts of the Middle East and sent to the Central Medical Laboratory for identification.

METHODS

The techniques used in the isolation and identification of these Salmonellae are all well recognized, and are not described in detail. Specimens of faeces were plated on desoxycholate-citrate agar both directly and after enrichment in Selenite F. Urine specimens were plated either directly on MacConkey’s agar or on desoxycholate-citrate agar after enrichment in Selenite F or a fluid MacConkey’s medium containing mannite. Pure cultures were obtained on MacConkey’s agar before identification.

Salmonellae were identified by their biochemical and agglutination reactions. The sera used in antigenic analysis were supplied by the David Bruce Laboratories. They were not absorbed, but their homologous titre was specified. Many of the strains required several passages through Craigie tubes before the flagellar antigens could be satisfactorily identified. Phase conversion was accomplished by the use of Craigie tubes containing the appropriate antiserum. Specific sera to individual second phase factors were not available in the Middle East, and consequently certain species could not be identified fully. For example, Salm. newport and Salm. kottbus could not be distinguished. Apart from this, all
types were identified at Fayid. All strains, other than *Salm. typhimurium*, were sent to the Salmonella Reference Laboratory of the Public Health Laboratory Service for final diagnosis or confirmation.

**The Cases**

The information available on each case is summarized in Table I. Three anaerogenic strains of *Salm. typhimurium* are noted. The organisms isolated from Case 23 and a further case have not been described previously and will be reported in full elsewhere. No further details of these cases are given here.

Sera were examined for both flagellar and somatic agglutinins to the isolated strain from Cases 1, 3, 6, 7, 8, 10, 11, 12, 13, 14, 17 and 20. Only one serum, taken during convalescence, was examined from some cases; from others 3 or 4 sera were taken during and after the illness. No flagellar agglutinins were present at a dilution of 1:20 and no rise in somatic agglutinins could be demonstrated. The infecting organism was isolated from the faeces of all these cases from whom sera were examined.

**Discussion**

A list of the species isolated together with the number of individuals from which each species was grown are shown in Table II. A high proportion of the Salmonellae reported were isolated from people who gave no history suggestive of a recent Salmonella infection. Also shown in Table II are the numbers of those without a recent illness and those giving a history of illness, either at the time of isolation of the organism or shortly beforehand.

Although a large number of specimens of stool and of urine from food-handlers have been examined in the laboratory during outbreaks of enteric fever, the number of Salmonellae isolated from these asymptomatic individuals was unexpectedly high. The lack of flagellar agglutinins in these asymptomatic people suggests that the organisms were confined to the intestinal tract.

**Summary**

The Salmonellae other than those causing typhoid and paratyphoid fevers, isolated and identified at the Army Central Medical Laboratory, Middle East, during 1950 and 1951, are enumerated. The clinical manifestations of the infections are briefly described.

**Acknowledgments**

We acknowledge with gratitude help received from the following:

Dr. Joan Taylor, who has examined all unusual Salmonella strains isolated at the Central Medical Laboratory, Fayid.

Lieut.-Colonel M. H. P. Sayers, O.C. David Bruce Laboratories, who has prepared a number of special sera for our use.

Major A. P. Goffe, who initiated the practice of identifying unusual
<table>
<thead>
<tr>
<th>Case number</th>
<th>Sex, Age, Nationality</th>
<th>Location of isolation</th>
<th>Species isolated</th>
<th>Source of culture</th>
<th>Clinical Summary and General Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M. 39 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Facies</td>
<td>Isolated during examination of food-handlers suspected of association with an outbreak of enteric fever. No illness or history of intestinal disorder.</td>
</tr>
<tr>
<td>2</td>
<td>F. 1 yr. 6 mths. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella typhimurium</em></td>
<td>Facies</td>
<td>Pyrexial illness of three days' duration accompanied by loose stools containing blood and mucus. Two other members of the family had loose stools during the preceding week.</td>
</tr>
<tr>
<td>3</td>
<td>M. 21 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Facies</td>
<td>Organism isolated during examination of food-handlers suspected of association with an outbreak of enteric fever. Mild fever for a few days six months prior to isolation of organism, but no pathogens isolated from twelve urine and twelve stool cultures at that time.</td>
</tr>
<tr>
<td>4</td>
<td>M. British</td>
<td>Benghazi</td>
<td><em>Salmonella typhimurium</em></td>
<td>Urine</td>
<td>An enteric-like illness characterized by fever, headache, rose spots over the trunk and a tender, palpable spleen. Chloromycetin commenced on 9th day of illness with good response. A total of 50 gms. given. <em>Salm. typhimurium</em> isolated from urine on 17th day of illness and from stools on 43rd day.</td>
</tr>
<tr>
<td>5</td>
<td>M. 5 mths. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Liver, small and large intestine, bone marrow and spleen at P.M.</td>
<td>Two weeks before death infant developed diarrhoea and vomiting which cleared up in a few days. The illness was followed by feeding difficulties due to a refusal to suck, loss of weight and finally, by rapid dehydration, collapse and death. At autopsy, no macroscopic changes were noted, but <em>Salm. typhimurium</em> was isolated from multiple sites.</td>
</tr>
<tr>
<td>7</td>
<td>M. 19 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella typhimurium</em></td>
<td>Facies</td>
<td>Isolated during clearance of a convalescent case of typhoid fever, proven by blood culture. Convalescence uneventful and patient asymptomatic at time of isolation.</td>
</tr>
<tr>
<td>8</td>
<td>M. 19 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Facies</td>
<td>Isolated during clearance of a convalescent case of mild clinical enteric fever, not proven bacteriologically, but connected with an outbreak of typhoid fever. Convalescence uneventful save for mild fever (100.5°F) on one day only nine days before isolation of organism.</td>
</tr>
<tr>
<td>9</td>
<td>M. 18 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Facies</td>
<td>Isolated twice during a brief febrile illness accompanied by diarrhoea and vomiting.</td>
</tr>
<tr>
<td>10</td>
<td>M. 18 yrs. British</td>
<td>Suez Canal Zone</td>
<td><em>Salmonella</em></td>
<td>Facies</td>
<td>Short episode of diarrhoea.</td>
</tr>
<tr>
<td>Case number</td>
<td>Sex, Age Nationality</td>
<td>Location of isolation</td>
<td>Species isolated</td>
<td>Source of culture</td>
<td>Clinical Summary and General Remarks</td>
</tr>
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</tr>
<tr>
<td>11</td>
<td>M. 20 yrs. British</td>
<td>Suez Canal Zone</td>
<td>Salmonella typhimurium, Anaerogenic strain</td>
<td>Feces</td>
<td>Abdominal pain, headache, diarrhea and vomiting lasting a few hours.</td>
</tr>
<tr>
<td>12</td>
<td>M. 18 yrs. British</td>
<td>Suez Canal Zone</td>
<td>Salmonella isangi, VI, VII d−1, 5 Salmonella kottbus, VI, VIII e, h−1, 5</td>
<td>Feces</td>
<td>Anorexia, headache and abdominal pain lasting three days. No bowel disturbance. Spleen palpable and tender.</td>
</tr>
<tr>
<td>13</td>
<td>M. 19 yrs. British</td>
<td>Suez Canal Zone</td>
<td>Salmonella kottbus</td>
<td>Feces</td>
<td>Isolated when testing food-handlers during an enteric outbreak. No recent illness.</td>
</tr>
<tr>
<td>14</td>
<td>M. 39 yrs. British</td>
<td>Suez Canal Zone</td>
<td>Salmonella kottbus</td>
<td>Feces</td>
<td>Isolated when testing food-handlers during an enteric outbreak. No recent illness. Cases 13 and 14 worked together in the same kitchen.</td>
</tr>
<tr>
<td>15</td>
<td>F. Adult British</td>
<td>Suez Canal Zone</td>
<td>Salmonella kottbus</td>
<td>Feces</td>
<td>Gastro-enteritis.</td>
</tr>
<tr>
<td>16</td>
<td>M. Adult Egyptian</td>
<td>Suez Canal Zone</td>
<td>Salmonella kottbus</td>
<td>Urine</td>
<td>Isolated during routine examination of native food-handlers.</td>
</tr>
<tr>
<td>17</td>
<td>M. Adult British</td>
<td>Suez Canal Zone</td>
<td>Salmonella morbillcan, VI, VIII r−1, 5</td>
<td>Feces</td>
<td>Isolated during routine examination of a food-handler. His only recent illness was an attack of abdominal pain and diarrhea, lasting four days, eight weeks previously.</td>
</tr>
<tr>
<td>18</td>
<td>F. 3 yrs.5mths. British</td>
<td>Suez Canal Zone</td>
<td>Salmonella eastbourne, I, IX, XII e, h−1, 5</td>
<td>Feces</td>
<td>Pyrexia, diarrhea and vomiting lasting two days.</td>
</tr>
<tr>
<td>19</td>
<td>M. Adult Egyptian</td>
<td>Suez Canal Zone</td>
<td>Salmonella eastbourne</td>
<td>Feces</td>
<td>Isolated when testing food-handlers during an enteric outbreak.</td>
</tr>
<tr>
<td>20</td>
<td>M. Adult Egyptian</td>
<td>Suez Canal Zone</td>
<td>Salmonella eastbourne</td>
<td>Feces</td>
<td>Isolated during routine examination of native food-handlers. No history of gastro-enteritis.</td>
</tr>
<tr>
<td>22</td>
<td>M. Adult Mauritian</td>
<td>Benghazi</td>
<td>Salmonella havana, I, XIII, XXIII f, g−</td>
<td>Feces</td>
<td>Short episode of diarrhea with blood and mucus in the stools. No pyrexia or constitutional disturbance. Sigmoidoscopy showed a hyperemic sigmoid colon.</td>
</tr>
<tr>
<td>23</td>
<td>M. Adult Mauritian</td>
<td>Suez Canal Zone</td>
<td>Salmonella tel-el-kebir, XIII, XXIII d−e, n, z18</td>
<td>Urine</td>
<td>Short illness accompanied by fever, headache, abdominal pain and diarrhea. Organism isolated at this time and repeatedly thereafter during the next five weeks. Examinations then ceased. Schistosoma hematobium ova present in urine.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Intestinal symptoms predominating</th>
<th>Constitutional symptoms predominating</th>
<th>No illness</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salm. zagreb</td>
<td>...</td>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; typhimurium</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>&quot; isangi</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>&quot; kottbus</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&quot; morbillans</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; eastbourne</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&quot; london</td>
<td>1</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>&quot; havana</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Salmonellæ in the Middle East, and has been intimately concerned with much of this work.

The officers and technicians who have been concerned in the isolation and identification of the Salmonellæ reported here. Those particularly concerned are: Capt. P. Chadwick, Capt. D. G. Rushton, Capt. I. O. Stewart, Lieut. J. F. Watkins and Corporal J. Miller.

The medical officers who have supplied us with clinical details of the cases.