Yersinia enterocolitica Infections in South Africa


SUMMARY

Yersinia enterocolitica infections are described for the first time in South Africa. The causative organism was isolated from 15 patients and 3 normal individuals. Gastroenteritis was the presenting feature in 10 cases, septicaemia in 4 (all with antecedent liver disease), and mesenteric adenitis in 1. The organism was isolated in 3 carriers.

The epidemiology of this disease was discussed, including the question of whether it constitutes a true zoonosis. The pig as a possible reservoir was investigated in an abattoir and the organism was isolated from one animal, and one worker had serological evidence of infection.

It is suggested that this disease should be considered in patients with the clinical features described above.


For several years the attention of microbiologists has been drawn to a new group of bacteria closely resembling the bacillus of Mallassez and Vignal (Past. pseudotuberculosis). Several provisional names were given to these bacteria in the past, and they have been called Bacterium enterocoliticum, Pasteurella pseudotuberculosis type b, and Pasteurella 'X'. The name Yersinia enterocolitica was proposed by Frederiksen who placed the organism in the new genus Yersinia, together with the bacillus of plague and that of pseudotuberculosis. Although closely resembling the latter, Yersinia enterocolitica is differentiated by various biochemical characteristics, antigenic structure, and its insensitivity to the specific phages of the other yersinias. In spite of this the bacterium seems to possess a natural pathogenicity similar to that of the bacillus of Mallassez and Vignal, and the anatomo-pathological pictures accompanying it in man and animals recalls that of infection with Yersinia pseudotuberculosis.

As far as its geographical distribution is concerned, the organism has been found predominantly in Western Europe, especially Sweden, Belgium, France, Denmark, Finland and Switzerland, also in central Europe (Czechoslovakia, Rumania, USSR) and sporadic cases have been observed in the USA and Canada. In Africa, human cases have only been reported from Tangier, and from the Democratic Republic of the Congo, although the organism was also demonstrated in Algeria where it caused an epizootic among pigs. This paper deals with the first 19 cases of Yersinia enterocolitica infection in South Africa.

MATERIALS AND METHODS

Positive cultures for Yersinia enterocolitica were obtained from routine specimens sent for microbiological investigation to the South African Institute for Medical Research, Johannesburg. These specimens came predominantly from the central group of Johannesburg Hospitals but also included specimens from various clinics and mission hospitals outside of the Johannesburg central area. The central laboratory of this Institute deals with approximately 14,000 stool specimens, 10,000 blood cultures, and 5,500 sera for Widal tests per year. In addition, the cooperation was obtained from the South African Institute for Medical Research branch laboratory staff at the Transvaal Memorial Hospital for children, and 8 isolates were obtained in their laboratory. Two further cultures were referred to us for identification, one from Bloemfontein and another from a private pathologist in Vereeniging.

Since February 1970 all specimens sent in for typhoid, brucella or rickettsial agglutination were screened for yersinia antibodies. The sera of patients from whom Yersinia enterocolitica was isolated were subsequently examined for antibodies, and those patients who were found to have positive serology had stool and blood cultured for the organism.

Bacteriological Techniques

Culture technique: Routine culture methods were employed. Stools were planted on SS and desoxycholate agar and inoculated into selenite broth. After 24 hours all plates were read and subcultures performed from the selenite broth onto further desoxycholate and SS plates. Blood cultures were performed by injecting 3 - 5 ml of blood into 50 ml of brain-heart infusion broth and this was subcultured at regular intervals. Other specimens were treated according to recognized standard procedures and all media were incubated at 37°C.

Bacteriological identification: Colonies having morphological features resembling Yersinia enterocolitica were Gram-stained and their biochemical reactions were tested using lactose, glucose, sucrose, mannitol, indole, dulcite. H,S and urea. Organism provisionally identified as Yersinia enterocolitica were tested for agglutinability against a homologous antiserum prepared in rabbits and were then submitted to Professor H. H. Mollaret at the Pasteur Institute in Paris for phage typing.

Serological investigation: Patients' sera were examined for agglutinins against both O and H antigens prepared according to the method of Winblad et al.
RESULTS

The strains which were isolated all showed similar morphological features, being small Gram-negative rods. Biochemical properties were identical except that some strains were xylose-positive whereas others were xylose-negative.

TABLE I. CHARACTERISTICS OF *YERSINIA ENTEROCOLITICA*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motility at 22°C</td>
<td>+</td>
</tr>
<tr>
<td>Motility at 37°C</td>
<td>-</td>
</tr>
<tr>
<td>Lactose</td>
<td>-</td>
</tr>
<tr>
<td>Glucose (acid)</td>
<td>+</td>
</tr>
<tr>
<td>Glucose (gas)</td>
<td>-</td>
</tr>
<tr>
<td>Mannitol</td>
<td>-</td>
</tr>
<tr>
<td>Sucrose</td>
<td>-</td>
</tr>
<tr>
<td>Maltose</td>
<td>Late</td>
</tr>
<tr>
<td>Indole</td>
<td>Variable</td>
</tr>
<tr>
<td>Urease</td>
<td>+</td>
</tr>
<tr>
<td>Xylose</td>
<td>Variable</td>
</tr>
<tr>
<td>Rhhamnose</td>
<td>-</td>
</tr>
<tr>
<td>H₂S</td>
<td>-</td>
</tr>
<tr>
<td>Nitrate reduction</td>
<td>+</td>
</tr>
<tr>
<td>Oxidase</td>
<td>+</td>
</tr>
<tr>
<td>Gelatine</td>
<td>-</td>
</tr>
<tr>
<td>Phenylalanine deaminase</td>
<td>-</td>
</tr>
<tr>
<td>Catalase</td>
<td>+</td>
</tr>
<tr>
<td>Methyl red</td>
<td>+</td>
</tr>
<tr>
<td>Voges-Proskauer</td>
<td>Variable</td>
</tr>
</tbody>
</table>

The characteristic reactions are given in Table I. All strains were agglutinable by specific antiserum prepared in a rabbit, and all belonged to phage type IX.

Eighteen strains of *Yersinia enterocolitica* were isolated on routine examination. Of these, 10 were isolated from the stool of patients suffering from acute gastro-intestinal disease. One strain was isolated from the faeces of a patient without symptoms referable to the gastro-intestinal tract but with retinal haemorrhages. Another 2 strains were obtained from healthy food handlers on routine stool examinations. In 2 of the patients with gastro-enteritis other pathogenic organisms were isolated; in one case a *Salmonella montevideo*, and in another enteropathogenic *E. coli*. Two strains were obtained from blood cultures in adults suffering from an acute typhoid-like illness, and one strain was obtained from a specimen of pus in a patient with abdominal pain, hepatomegaly and diarrhoea, who later developed an osteitis of the parietal bone. In addition one strain was isolated from mesenteric lymph nodes in a male with mesenteric adenitis, and one from the dialysis fluid of a child with congenital hyperplastic kidneys who developed a mild pyrexia with diarrhoea.

The predominant symptoms and agglutination titres of the 18 patients with positive *Yersinia enterocolitica* cultures are summarized in Table II.

In addition to these proved cases, a number of sera were found which gave positive agglutination tests against *Yersinia enterocolitica*, but the organism could not be recovered in these cases. Most of these sera were from

TABLE II. SYMPTOMS AND AGGLUTINATION TITRES OF 18 PATIENTS WITH POSITIVE CULTURES

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Age</th>
<th>Sex</th>
<th>Symptoms</th>
<th>O Agglutination</th>
<th>H Agglutination</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adult</td>
<td>M</td>
<td>Diarrhoea and vomiting</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>10 yrs</td>
<td>M</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>50 yrs</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>11 mo.</td>
<td>F</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>1 yr 3 mo.</td>
<td>F</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>1 yr 6 mo.</td>
<td>M</td>
<td>+</td>
<td>?</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Adult</td>
<td>M</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>1 yr</td>
<td>M</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>3 yrs</td>
<td>M</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>23 yrs</td>
<td>M</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>50 yrs</td>
<td>F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>4 mo.</td>
<td>F</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>5 yrs</td>
<td>M</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Adult</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>Adult</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>2-2½ yrs</td>
<td>M</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>17</td>
<td>Adult</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>18</td>
<td>10 mo.</td>
<td>M</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The predominant symptoms and agglutination titres of the 18 patients with positive *Yersinia enterocolitica* cultures are summarized in Table II.

In addition to these proved cases, a number of sera were found which gave positive agglutination tests against *Yersinia enterocolitica*, but the organism could not be recovered in these cases. Most of these sera were from
patients with pyrexia of unknown origin coming from rural areas, and in many cases typhoid or paratyphoid serology was also positive in association with raised Yersinia enterocolitica titres.

DISCUSSION

Yersinia enterocolitica, which previously received attention mainly from veterinarians, has in the last 8 years been shown to be an important pathogen in man causing mesenteric adenitis, erythema nodosum, septicemia and especially enteritis and enterocolitis. Several recent cases of human infection with Yersinia enterocolitica induced us to draw the attention to syndromes due to this bacterial species. It must be emphasized that none of the known clinical presentations are in themselves specific. Only the laboratory is able to establish the diagnosis either by stool culture or other techniques. Our cases tended to follow the clinical pattern reported by other workers.

Gastro-intestinal Form

As pointed out by several workers presentation with diarrhoea and vomiting is by far the commonest, especially in patients under the age of 5 years. These children present with varying degrees of diarrhoea and vomiting, mild to moderate abdominal pain and pyrexia. In the absence of antibiotic treatment, recovery is slow and symptoms may persist for a number of months. In our series 10 cases presented in this fashion and the following is a typical case history:

Case 1 (No. 18)

The patient was a White male infant, aged 10 months, who developed fever and diarrhoea while visiting a farm with his parents. Other children in the same family developed similar illness and there was a history of drinking water from a well in which a dead rodent was subsequently found. All the children recovered after about 2 days but the baby remained ill with diarrhoea. Ampicillin treatment was instituted for about 10 days but a mild diarrhoea persisted. At this stage a stool culture yielded Yersinia enterocolitica. Ampicillin was stopped and 2 days later the diarrhoea improved without further antibiotic treatment.

Mesenteric Adenitis and Acute Terminal Ileitis

In 1954 Knapp and Masshoff found Yersinia pseudotuberculosis in inflamed mesenteric lymph nodes and since then numerous workers have described the bacteriology, serology and histopathology of Masshoff disease, i.e. mesenteric lymphadenitis caused by Yersinia pseudotuberculosis. In 1964 Carlsson et al. first reported the presence of Yersinia enterocolitica in a mesenteric lymph node from a patient with acute terminal ileitis and mesenteric adenitis. Since that time many reports of similar cases have been published, and other workers have stressed the similarity between this syndrome and the features of acute appendicitis. Winblad et al. found that a large portion of patients in Sweden presenting with acute appendicitis had antibodies against Yersinia enterocolitica. In their series the organism was isolated from 3.8% of patients who had had an appendectomy and was especially likely to be found in those with acute terminal ileitis.

The clinical picture of mesenteric adenitis and acute terminal ileitis resembles that of Yersinia pseudotuberculosis infection, presenting with a sudden pyrexia, epigastric pain which localizes itself in the right iliac fossa, and a moderate leucocytosis. During surgery numerous inflamed glands are found which may be associated with an oedematous and reddened ileum. The following patient demonstrated some of these features:

Case 2 (No. 14)

An adult Bantu male was admitted to the Discoverers Hospital with mild diarrhoea and vague abdominal pains. He was found to have a moderately enlarged liver, ascites and a low-grade fever. X-ray examination failed to show evidence of old or active tuberculosis and stool examinations for Entamoeba histolytica were negative. His blood count was essentially normal with a haemoglobin level of 14.2 g/100 ml and a leucocyte count of 7600/mm³ with a normal differential count.

After aspiration of ascitic fluid, a deep abdominal mass was palpated and exploratory laparotomy was performed. At operation mesenteric lymph nodes were found which were matted together forming a large retroperitoneal mass. Portions of this were removed for histological and bacteriological examination. The liver was found to be cirrhotic. After operation the patient was treated with broad-spectrum antibiotics including streptomycin and tetracycline and he made an uneventful recovery. Yersinia enterocolitica was isolated from the ascitic fluid and from the mesenteric lymph glands.

Histological examination of the glands showed chronic nonspecific inflammation with marked fibrosis and plasma cell infiltration.

Septicaemic Form

Since the first description by Hassig et al., a number of cases of Yersinia enterocolitica septicaemia have been reported. The condition resembles that of typhoid fever with an abrupt onset of malaise and diarrhoea associated with non-specific symptoms of pyrexia, loss of weight and headaches. There may be hepatomegaly, varying degrees of jaundice and confusion. Death may follow. Many of the patients reported in the literature with this form of the disease have been subjects of over 60 years of age with antecedent hepatic disease. In our series, 4 patients showed evidence of liver disease. In addition to the 2 cases described below, 1 patient (No. 3) was an alcoholic with cirrhosis who presented with a pneumonitis and a bacteraemia (Y. enterocolitica was isolated from a blood culture). The clinical details of the other patient (No. 14) have been described above.

Case 3 (No. 7)

An elderly Bantu male patient was admitted to Shongwe Mission Hospital in an advanced state of attrition, following diarrhoea of uncertain duration. On examination he was found to be malnourished with severe stomatitis, a two-finger hepatomegaly, and a pyrexia of 101°F. The picture resembled typhoid fever but neck stiffness developed later and cerebral
malaria was then suspected. Blood cultures were submitted to the laboratory but the patient died before the results became available. *Yersinia enterocolitica* was isolated from the blood culture bottle after 48 hours' incubation.

**Case 4 (No. 17)**

A 69-year-old Bantu male presented with pain over the upper abdomen and was found to have a pyrexia, hepatomegaly and evidence of recent weight loss. Special investigations showed anaemia (haemoglobin 7.2 g/100 ml), an erythrocyte sedimentation rate of 110 mm/hour, and deranged liver function tests.

The patient developed a left-sided pleural effusion with a productive cough and a chest X-ray revealed in addition an opacity in the posterior segment of the lower lobe. Further investigation showed a splenic abscess extending to the diaphragm, and after drainage and splenectomy, a cystic swelling appeared over the left parietal bone which radiologically showed the features of an osteitis. Aspiration was performed and *Y. enterocolitica* was isolated. Serological investigation yielded specific titres of 1:50 and 1:400 for O and H agglutinins respectively.

**Erythema Nodosum**

Although gastro-intestinal infection was considered as a cause of erythema nodosum in 1912, little attention was paid to it until Mollaret published a report in 1964 concerning a female who developed erythema nodosum 17 days after a laparotomy at which suppurative mesenteric adenitis was found. Serological tests for *Yersinia enterocolitica* were positive. In 1969 Hannukesela and Ahvonen investigated 102 unselected adult patients with erythema nodosum and, on the basis of high agglutination titres, found that *Yersinia enterocolitica* was the probable cause in 10% of these patients. Nilén and Sjöström reported 8 cases of erythema nodosum caused by this organism and noticed that in all of them, skin lesions were preceded by gastro-intestinal symptoms and fever. The skin lesions generally tended to resolve in 1 week. A further curious observation is that all cases were adult females with ages ranging from 21 - 68 years. In our series erythema nodosum was not seen but it should be noted that only one adult female was included in the study.

**Polyarthritic Form**

Ahvonen et al. during a 3-month period in 1968 examined 3,875 sera sent in for tests for rheumatoid factor and found that 46 (1.2%) had a *Yersinia enterocolitica* agglutinating titre of 160 or higher. Nineteen of these patients had polyarthritis with acute onset, 14 had arthralgia, 11 had erythema nodosum and 2 had iritis. Most of these patients had preceding fever and gastro-intestinal symptoms, and interphalangeal joints, knees and ankles were the joints which were most frequently affected. A significant reduction in *Y. enterocolitica* titre took place within 3 months in each case. All of these cases were adults and females again predominated. The small number of such patients in our series might explain the absence of arthritis in any of our cases.

**Miscellaneous**

A wide variety of clinical presentations have been reported in the literature where *Yersinia enterocolitica* was isolated, but where a causal relationship was not always definitely established. Among these reports were patients with inflammatory cutaneous lesions, intestinal ulcers with chronic diarrhoea, and meningitis. In one patient with meningitis the organism was recovered from cerebrospinal fluid, urine, eye, blood and petechiae, almost definitely an indication of a pathogenic role in this case.

**Case 5 (No. 10)**

A White male, aged 23 years, presented at the Johannesburg General Hospital with a history of chronic diarrhoea, blood in the stools, and abdominal pain for 10 years. At sigmoidoscopy numerous shallow ulcers were noted in the rectum, and a biopsy was done on one. On histological examination a non-specific chronically inflamed superficial ulcer was noted, in the base of which a small amount of amorphous material was seen, the nature of which could not be determined. *Yersinia enterocolitica* was isolated from the stool and antibodies against this organism were detected in the serum (1:100, H 1:50). The patient was treated with a course of tetracycline and to date (9 months later) his symptoms have not reappeared.

**Case 6 (No. 11)**

An adult White female consulted an ophthalmologist and was found to have a retinal haemorrhage. In the course of investigations *Yersinia enterocolitica* antibodies were found in high titre (1:800) in her serum and the organism was isolated from her stool. The patient denied having had gastro-intestinal or any symptoms other than those associated with her eyes. The pathogenic role of this organism in this patient is uncertain.

**EPIDEMIOLOGY**

The presence of *Yersinia enterocolitica* in many animal species suggests that the disease is a zoonosis. Its similarity to *Yersinia pseudotuberculosis* strengthens this view. However, in spite of much evidence, in support of a zoonosis, there is no definite proof of a connection between human and animal illness.

**Reservoir of Human Strains**

Although the organism has been recovered from a large variety of animal species (chinchillas, hares, monkeys, antelopes, horses, dogs, etc.) it is only the pig which has regularly been found to carry the same serological group as that found in man (Serogroup 3). For this reason workers have orientated their epidemiological investigations towards this animal, and the organism has been recovered from the stool and mesenteric lymph glands of apparently healthy pigs by a number of workers. We examined the stool and mesenteric lymph nodes of 200 randomly selected pigs at the Johannesburg abattoirs, and isolated *Yersinia enterocolitica* from one of these
animals. Furthermore, serological examination of 15 healthy abattoir workers responsible for the slaughtering of pigs, showed a raised *Yersinia enterocolitica* titre in one of them, suggesting past contact with the organism.

A further argument in favour of a connection between human infection and carriage by pigs, is the observed geographical incidence of strains. The bacteriophage types which are commonly responsible for human infection are types VIII, IX and X. Types VIII and X are regularly isolated in Europe, whereas type IX has been found only in Canada and South Africa. The porcine strains similarly belong to the same 3 phage types, and their geographical distribution corresponds to that found in man, i.e. in Europe the porcine strains have been types VIII and X, whereas the one strain found in Johannesburg has been type IX. It is therefore envisaged that the pig is a reservoir of the majority of human strains. However, other possible reservoirs have not yet been excluded. Because of the finding of symptomless carriers man himself may prove to be an important reservoir of *Yersinia enterocolitica*.

**Portal of Entry**

The frequency of digestive symptoms and the high incidence of lesions in the ileum, appendix and mesenteric lymph glands suggest the digestive route as the portal of entry. The simultaneous recovery of *Yersinia enterocolitica* from patients with other enteropathogenic bacteria, especially salmonellas, has been recorded by several authors and strengthens the hypothesis of a gastrointestinal origin. In our series 2 patients were found to have mixed infections, in the one case with a *Salmonella montevideo* and in the other with an enteropathogenic *E. coli*. Furthermore, a number of sera sent in for routine Widal examinations showed *Yersinia enterocolitica* antibodies in association with positive typhoid or paratyphoid serology, again suggesting mixed infection and a common origin for the infections. The seasonal incidence moreover, tends to follow that of other gastro-intestinal diseases, in that most of our cases have been found during the summer months (Fig. 1). This has not been the case in Europe where the infection is lowest during the summer.

Although these facts would tend to favour an oral infection, the respiratory route and the swallowing of inhaled organisms should be considered as alternative modes of spread. Pahl, working with pigs, isolated the organism from the faeces of neighbouring animals which were accommodated in such a way as to exclude all methods of transmission other than the aerial route.

**Mode of Infection**

Although direct contact with a sick or carrier animal could account for a few of the cases reported in the literature, the young age of many of our patients, and the denial of any contact with animals by the majority...
of patients, would suggest that this is an unimportant mode of infection.

Food, particularly pig meat and its derivatives, could be an important vector of the infection, and Makulu et al., 20 while examining the staff of butchers in Kinshasa, found 3 healthy carriers among them. According to the literature, however, the organism has not been recovered from food except on one occasion from ice-cream and once from a specimen of milk. 21

Several reports 22,23,24 of infections within the same household would suggest that interhuman transmission, either direct or indirect could play an important role in the dissemination of the disease. Wauters, 25 while examining 50 families in which cases of Yersinia enterocolitica infection occurred, noted that in 17 of these, more than one member of the household was affected. He also reported a small epidemic in a paediatric unit, 26 and noted that most infections do not occur simultaneously but follow each other by a few days. This suggests that there is some interhuman transmission and that these cases did not arise from a single contaminated source.

Treatment

The sensitivity to antibiotics presents few variations and using the disc technique all strains were sensitive to streptomycin, tetracycline, kanamycin, chloramphenicol, gentamicin and colistin. The European strains have been reported as being resistant to ampicillin, 27 but our strains showed varying sensitivity, the majority being moderately resistant with minimal inhibitory concentrations of 12.5 µg/ml or more. A few however, were moderately sensitive. As with other yersinias, they are resistant to penicillin G.

It is difficult to assess therapeutic results, as large epidemics have not occurred where controlled trials could be undertaken. In other yersinoses, parenteral streptomycin has proved itself and good results have been obtained in Yersinia enterocolitica infection. Lilén et al. 28 obtained satisfactory results with tetracyclines, and Van Noyen et al. 29 used chloramphenicol with success.

We wish to thank the Director of the South African Institute for Medical Research for permission to publish, and Professor H. H. Mollaret of the Pasteur Institute, Paris, for phage typing our strains. Our thanks are also due to Dr P. J. Meara, Director of the City of Johannesburg Abattoir and Livestock Market Department, for facilities granted, and to Mr R. Raymond, for assistance in the collection of specimens.

ADDENDUM

An additional confirmed case of Yersinia enterocolitica septicaemia with arthritis in a young adult suffering from thalassemia major, has been diagnosed at the Johannesburg General Hospital. This interesting case will be reported separately at a later date.

REFERENCES