ATYPICAL ENTERIC INFECTIONS.

A REPORT OF FOUR CASES.

BY

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BACTERIOLOGICAL investigation of material obtained at necropsies in the Royal Infirmary, Edinburgh, have recently demonstrated the presence of organisms of the enterica group in cases which during life have presented quite atypical features. The object of the present communication is to illustrate by means of four cases the apparent frequency of such infections (see Billet and others, 1910). In each of the cases the diagnosis of enterica was not made until specimens obtained at the necropsies were examined bacteriologically, although in one case the "step-like" rise of temperature had aroused clinical suspicions of enteric infection.

Such atypical cases may be either primary infections or acute exacerbations in a chronic carrier. They are liable to be diagnosed incorrectly, and the consequent absence of suitable precautions would then promote the spread of the infection.

As emphasized in the report by Dr. Brincker on the outbreak of paratyphoid fever in London in 1928, infections with certain organisms of the paratyphoid group were comparatively rare in Britain before the war. Since then, however, large numbers of individuals, after a sojourn in areas where such infections are endemic, have become carriers. The temporary carrier, convalescent from a recognized attack of enteric fever, is likely to be watched by careful sanitary authorities, but chronic convalescents, and especially paradoxical and transitory carriers, by the intermittent discharge of pathogenic organisms for many years, constitute a serious potential danger to the community. The length of time during which such carriers harbour the bacilli of course varies, and depends on the establishment of chronic lesions (Sacquépée, 1910). That the number of such individuals discharging these organisms is relatively great is supported by the demonstration of *B. typhosus* in Belfast sewage by Wilson (1928) and of *B. paratyphosus* B Schottmüller in Edinburgh sewage by myself in 1929. The comparative freedom of these towns from enteric fever during the investigations renders it probable that these findings were due to the presence of resident carriers or unrecognized cases of the disease.

CASE I.

Clinical History.—A painter, aged 63, was admitted with a three days' history of abdominal pain, diarrhoea, and the vomiting of a clear, and later a dark green, fluid; he was stated to have been "pale and ashen," and to have had a temperature of 101° F. two days before admission.

On admission he was moribund; temperature 98.6°; pulse feeble 80; respirations 28. He was sweating slightly, but there was no rash. He complained of pain, constant and gnawing, over the whole abdomen, but not radiating in any special direction. Apart from slight rigidity over the upper part of the right rectus muscle, the abdomen was flaccid. He died the following day.

Previous History.—Similar but less severe attacks had been experienced every few months for some years; thirty years ago he had travelled widely as the mate of a merchant ship. There was no history suggestive of enteric fever in the patient or his relatives.

Post-mortem Findings.—The peritoneal cavity, stomach, and both large and small intestines were all healthy, but the liver was fatty and congested. The gall-bladder was not thickened or enlarged, but contained rather thick opaque and greenish bile. The spleen was not enlarged, and the kidneys were congested and toxic. There was no pneumonia.

Bacteriology.—The bile yielded an almost pure growth of an organism identified by agglutination and agglutinin-absorption tests as *B. paratyphosus* B Schottmüller, and the same organism was isolated from the intestinal contents.

Discussion.

The clinical data and bacteriological findings suggest an acute exacerbation of a chronic cholecystitis due to *B. paratyphosus* B Schottmüller.

In the course of enteric fever the causative organisms are always present in the gall-bladder (Chiari, 1894, and

Pratt, 1901). Owing to the invariable bacteraemia in the early stage, the avenue of infection to the viscera is generally thought to be the hepatic circulation. Blumenthal (1907), Laubenheimer (1908), Garbat (1916), and Kuester (1918), however, have all given evidence in support of the possibility of an ascending infection from the duodenum, and Nichols (1917) believes in a descending infection from the liver. Pratt (1901) divided cases of typhoid cholecystitis into two classes: (1) cholecystitis secondary to typhoid enteritis, and (2) cholecystitis due to a primary infection of the gall-bladder. Experimentally, cholecystitis has been produced by many workers by the intravenous inoculation of typhoid bacilli (Rosenow, 1916).

That normal bile is not a suitable pabulum for the growth of organisms was shown by Förster, and, later, by Drennan (1922) and Johnson (1925). Drennan, however, showed that the inhibitory power of the bile was annulled by the addition of albuminous material sufficient to render the final concentration of bile not more than 70 per cent. In cases of enteric fever the albuminous material is supplied by the inflammatory exudate from the gall-bladder and bile ducts.

In most cases this "cholecystitis typhosa" subsides within at most a year of the recovery of the patient, but in about 2 to 5 per cent. of cases the bacilli persist in the gall-bladder for many years, the subjects then becoming chronic carriers of the organism. It is impossible to determine the date and primary site of the infection in the case recorded above. If infected abroad, the patient must have carried the bacilli for at least thirty years—most probably in the gall-bladder. Cases in which an attack of enteric fever preceded the detection of the carrier condition by forty-six and fifty-two years respectively have been recorded by Bolduan and Noble, and by Gregg. Actual cholecystitis—that is, clinical or pathological evidence of inflammation of the gall-bladder—following attacks of enteric fever by periods varying from seven to forty-one years have been recorded by Miller (1898), Hunner (1899), Dean (1908), Clairmont (1911), and Pomeroy and Shen (1925). Dean's case resembles the case recorded in being one of remittent biliary colic.

CASE II.

Clinical History.—Housewife, aged 76, admitted with five days' history of intermittent severe epigastric pain and vomiting occurring several hours after meals; the bowels were irregular and the stools contained blood. Similar, but less severe, attacks had been experienced for some years.

On admission she was acutely ill, but there was no jaundice or rash; the whole abdomen, though flaccid, was tender, especially in the epigastrium and over the gall-bladder. The temperature, which had been 99°, became subnormal; but on the second day after admission it rose to 103°, became swinging, and the patient died the following day with a temperature of 104°.

Previous History.—The patient had never been abroad, and there was no history suggestive of enteric fever in the patient or any of her relatives.

Post-mortem Findings.—The peritoneal cavity, liver, and stomach were all healthy; the gall-bladder contained two conical stones, each one inch in length and lying with the flattened surfaces apposed. The mucosa of the gall-bladder was thickened owing to fibrosis and recent inflammation, and, in apposition to the space between the stones, there was a deeply ulcerated and nearly perforated gutter round the whole circumference of the viscus. The gall-bladder was fibrosed and adherent to the liver tissue; the ducts were patent. The first part of the duodenum presented a stellate scar, and the second part a small acute ulcer. The lower end of the ileum was slightly congested, but there was no swelling or ulceration of the lymphoid tissue. The transverse, descending, and sigmoid colons all showed numerous ulcers. Each ulcer was a quarter to half an inch in diameter, and had raised edges and a necrotic floor. The spleen was small, and the pulp dark and diffuent. The other viscera were comparatively healthy.

Bacteriology.—An organism identified by agglutinin-absorption tests as *B. paratyphosus* B Schottmüller was isolated from the ulcers in the duodenum and large bowel, the intestinal lymph glands, the gall-bladder, and the interior of one of the gall-stones. In the spleen the same organism was present in pure culture.

Discussion.

This case is similar to the first, but with the addition of a concomitant cholelithiasis and generalized infection in which the situation of the ulcers was quite atypical. It seems probable that this case was an old-standing infection, since the demonstration of *B. paratyphosus* B Schottmüller in the interior of one of the stones is strong

evidence that it was the primary etiological agent concerned in the production of the stone. It is unlikely that enteric organisms penetrate preformed gall-stones (Pratt, 1901), and from the experiments of Dmochowski and Janowski it has been deduced that "in clinical cases where the typhoid bacillus is present alone it is improbable that other organisms were present at an earlier date." Presumably, therefore, the patient was a chronic carrier, developed gall-stones, and finally succumbed to an acute generalized infection. Such is undoubtedly a rare sequence of events, as Kuester did not observe a single disturbance which could be ascribed to the enteric organism in 800 chronic carriers kept under observation for two and a half years, and, according to Zinsser, carriers appear to possess a degree of resistance to second attacks higher than even that of the individual who recovers completely.

In addition to the usual tendency to obstruction to the flow of bile in all cases of cholecystitis, the presence of *B. typhosus* appears to have a special faculty of precipitating cholesterol from bile salts (Gilbert and Fournier, 1897; Richardson, 1899; Cushing, 1899; Doerr, 1905; and Exner and Heyrovsky, 1908), although Novzari (1928) does not believe that such infection predisposes to cholelithiasis. Pratt (1901) and Hertz and Adams (1909-1910) have recorded the formation of cholesterol stones containing *B. typhosus* within eighteen and sixty-eight days respectively from the apparent onset of typhoid fever. On the other hand, Dowd (1911) has reported the demonstration of *B. typhosus* in stones thirty-two years after typhoid fever.

CASE III.

Clinical History.—A brewery worker, aged 35, was admitted with a history of nausea for twenty-four hours and the sudden emesis of dark blood-stained material on three occasions on the day of admission. The bowels were regular and there had been no loss of weight.

On admission examination of the abdomen was negative except for slight tenderness and rigidity in the epigastrium. The spleen was not palpable and the stomach and liver were normal in size. Temperature 97.0°; pulse 120. The patient became rapidly weaker, and died on the fifth day after admission. The temperature showed a "step-like" rise, but never rose about 100.2°. There was no diarrhoea, although on the day before death the stools resembled the "pea-soup" variety.

Previous History.—Apart from being in France during the war, the patient had never been abroad, and there was no history suggestive of enteric fever in the patient or any of his relations.

Post-mortem Findings.—The peritoneum was healthy. The stomach contained bile-stained fluid and showed submucous haemorrhages. The small intestine was slightly inflamed, and although one of the Peyer's patches was ulcerated, there was no swelling of the lymphoid tissue. The naked-eye appearances of the large bowel and gall-bladder were healthy, but the liver and kidneys showed acute parenchymatous degeneration. The spleen was small, dark, and diffident.

Bacteriology.—*B. paratyphosus* B Schottmüller was isolated from an emulsion of the crushed wall of the gall-bladder, the organism being identified by agglutinin-absorption tests. The heart blood, spleen, and bile were all sterile, and no non-lactose-fermenting organisms were isolated from the ileal ulcer, ileal contents, and emulsion of the liver. Serum obtained from the cadaver did not agglutinate a known *B. paratyphosus* B emulsion at a dilution of 1 in 25 or higher dilutions.

Discussion.

The case is peculiar in that, although the heart blood, spleen, bile, and intestinal contents did not show evidence of the presence of *B. paratyphosus* B Schottmüller, the organism was found in the gall-bladder wall. The examination of the latter was made in view of the fact that in cases of cholecystitis Rosenow (1916) and A. L. Wilkie (1928) have isolated from the wall of the gall-bladder a streptococcus which could reproduce the disease in animals.

The presence of the organism in the wall, and its absence from the lumen of the gall-bladder, may be accounted for by the supposition that the viscus contained a percentage of bile too great for the viability of organisms. The failure to demonstrate *B. paratyphosus* B Schottmüller in the ileal ulcer and contents may have been due to the fact that in the interval between death and necropsy (eighteen hours) there occurred an overgrowth of lactose-fermenting organisms which masked the presence of enteric organisms present at the time of death. On the other hand, the patient may have been carrying the organisms in the wall of the gall-bladder, which, prior to the

death of the patient, was not discharging them into the lumina of the gall-bladder and intestines. This would be in keeping with the normal appearance and sterility of the bile. Pratt (1901) stated that in two cases he had found the enteric organism in the gall-bladder, but not in the heart blood, spleen, liver, and kidney. Fletcher and Lesslar (1925), who recorded a case of typhoid septicaemia without typhoid ulcers, regarded as an open question whether their patient was a chronic carrier in whom the septicaemia resulted from an old focus in the gall-bladder or whether the latter had become recently infected as part of the general septicaemia.

CASE IV.

Clinical History.—A domestic servant, aged 24, was quite well till a fortnight before admission, when she developed a "cold." A week later, owing to constipation, she took large doses of salts, since when she had had diarrhoea. For two days prior to admission generalized abdominal pain was felt, especially on the right side. There was no vomiting.

On admission the tongue was furred; the whole abdomen was tender, and in the lower part slightly resistant. There was no rash or recognizable enlargement of the spleen. The temperature was 102°. The abdomen was opened, and, as no pathological condition was found, was closed immediately. The temperature swung between 99.6° and 103.6°. Blood withdrawn two days after admission gave a pure culture of *B. typhosus*, and the serum agglutinated that organism in dilutions up to, but not higher than, 1 in 30. The urine (catheter specimen) was sterile on culture, but contained a few epithelial and red blood cells. The patient became gradually worse, and died four days after admission.

Previous History.—The patient had never been abroad, and there was no history suggestive of enteric fever in her or in any of her associates.

Post-mortem Findings.—The peritoneal cavity and stomach were healthy. Small, deep, punched-out ulcers, swelling of the Peyer's patches, and congestion of the surrounding mucosa were seen in the ileum, but there were no ulcers in the duodenum, jejunum, and large intestine. The liver showed advanced fatty degeneration but no necrosis, and the gall-bladder was healthy. The size and consistency of the spleen were normal. The kidneys showed fatty degeneration. There was no pneumonia.

Bacteriology.—*B. typhosus* was isolated in pure culture from the heart blood, spleen, liver, and bile, and from among lactose-fermenting organisms in the gall-bladder wall and caecal contents.

Discussion.

The clinical data and bacteriological findings suggest an acute primary infection, and illustrate how such a condition may simulate an acute abdominal lesion—for example, acute appendicitis. The ulceration of the ileum indicates that the condition had reached at least the eighteenth day, and yet the patient went about until within six days of her death. "Some of the most fatal cases have been those in which the patient was able to keep his feet with comparatively little inconvenience until the end of the third week" (Kerr, 1920).

DISCUSSION OF THE CASES.

The clinical picture presented by the four cases is indefinite. The most marked feature was the severity of the toxæmia in relation to the vagueness of the subjective and objective phenomena. The first patient was ill for only four days, the second for eight, the third for six, and the fourth for eighteen days. Enteric bacilli contain a non-specific endotoxin, and, according to Park, Williams, and Krumwiede (1925), the intestinal lesions may be absent and "some of the inflammatory complications which occur in typhoid fever are due to the growth of the bacillus in excessive numbers in unusual places in the body." The occurrence in enteric fever of sudden death from myocarditis and vasomotor paralysis has recently been emphasized by Jacobi (1927).

Generalized abdominal pain was common to all of the cases, and three of the four had vomiting and diarrhoea. In all, at least part of the abdomen was flaccid, and the rigidity, when present, was only slight. The absence of recognizable enlargement of the spleen and of rash was noteworthy. The temperature in all but one of the cases recorded failed to show the classical "step-like" rise, and a low pulse-temperature ratio was not present in any of the cases.

SUMMARY.

1. Four cases of atypical infection with typhoid-paratyphoid bacilli are discussed. 3 of *B. paratyphosus* B and

1 of *B. typhosus*. Of these, two presented the clinical picture of cholecystitis—one having gall-stones. The gall-bladder wall of the third case was the only part of the body found to be infected with the enteric organism. The fourth simulated acute appendicitis. All four cases presented profound toxic manifestations, an irregular temperature and abdominal pain. Examination of the abdomen revealed at most only slight rigidity, no rash, and no recognizable enlargement of the spleen.

2. A plea is made for thorough bacteriological examination of cases with vague abdominal symptoms which do not correspond closely to any mild digestive disturbance or acute abdominal condition.

3. In the interests of the community, enteric carriers should be "tracked down," and, when necessary, administrative action should be taken to minimize their danger to those around them, especially by prohibiting their employment in any business where food is handled.

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A REVERSIBLE BED FRAME FOR SPINAL AND OTHER SPECIAL CASES.

BY

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DURING the war one had frequent necessity for a bed which would give ready access to the back or buttocks without moving the patient. Especially did this need arise in cases of spinal injury, in which special daily attention to the skin was required in order to prevent or to treat bedsores. At first we were content with the Pearson's bed, in which the frame is high and the patient is supported on transverse canvas slips, any of which can be removed. But this device is very difficult and uncomfortable for nursing, because the nurse has practically to creep under the bed, and even then the back is seen with difficulty. We then had a tubular frame or cage made which was held inside a Pearson's bed frame and was made to turn over. This gave ready access to the back, and proved so useful that when the war was over a special bed was designed

which should embody these principles. This has been carried out, and for the expenses of the work I am most grateful to the Association of Surgeons for a grant which they made me for the purpose. The design which was first elaborated was, I think, too complicated, as it included

FIG. 1.

a device whereby the cage in which the patient lay could be tilted about a transverse axis, as well as rotated round a longitudinal one. In actual practice we found that the former movement was used so seldom that it was not worth while to have it provided for, as the same effect can be

FIG. 2.

attained by lifting the head end of the bed frame and supporting it by two chains placed under the transverse bar.

The model which I am here describing has now been in constant use for the past few years, and it has passed the critical test of those sisters and nurses of the Bristol

FIG. 3.

General Hospital who have been most enthusiastic in helping me to perfect its details.

The accompanying figures will, I think, serve to illustrate the construction and working of the bed. Fig. 1 shows the patient lying on his back, the head being raised on a pillow. The mattress is made in two longitudinal