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REFERENCES

- Carpentier, P. J., Stolte L. A. M., and Visschers, G. P. (1956). *J. clin. Endocr.*, 16, 155.
 del Castillo, E. B., de la Balze, F. A., and Argonz, J. (1947). *Ibid.*, 7, 385.
 Davidson, W. M., and Smith, D. R. (1956). *Postgrad. med. J.*, 32, 578.
 Dorff, G. B., Appelman, D. H., and Liveson, A. (1947). *J. clin. Endocr.*, 7, 807.
 Gordan, G. S., Overstreet, E. W., Traut, H. F., and Winch, G. A. (1955). *Ibid.*, 15, 1.
 Greenblatt, R. B., Carmona, N., and Higdon, L. (1956). *Ibid.*, 16, 235.
 Grumbach, M. M., Van Wyk, J. J., and Wilkins, L. (1955). *Ibid.*, 15, 1161.
 Hertz, R., Cromer, J. K., and Westfall, B. B. (1950). *Ibid.*, 10, 610.
 Hoffenberg, R., and Jackson, W. P. U. (1957). In preparation.
 ——— and Muller, W. H. (1957). *J. clin. Endocr.* In press.
 Kerkhof, A. M., and Stolte, L. A. M. (1956). *Acta endocr. (Kbh.)*, 21, 106.
 Lisser, H., Curtis, L. E., Escamilla, R. F., and Goldberg, M. B. (1947). *J. clin. Endocr.*, 7, 665.
 Rossi, E., and Cafisch, A. (1951). *Helv. paediat. Acta*, 6, 119.
 Solis, J., and Schwartz, M. M. (1951). *Rev. méd. Rosario*, 41, 3.
 Sternlieb, I., Zende, J., and Wilson, L. (1954). *N.Y. St. J. Med.*, 54, 1663.
 Sun, L. C. Y., and Rakoff, A. E. (1956). *J. clin. Endocr.*, 16, 55.
 Swyer, G. I. M. (1955). *British Medical Journal*, 2, 709.
 Varney, R. F., Kenyon, A. T., and Koch, F. C. (1942). *J. clin. Endocr.*, 2, 137.
 Wilkins, L., and Fleischmann, W. (1944). *Ibid.*, 4, 357.
Year Book of Endocrinology, 1955-1956, edited by G. S. Gordan, p. 258. Year Book Publishers, Chicago.

HUMAN INFECTION WITH SALMONELLA CHOLERAESUIS

BY

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Salmonella choleraesuis differs from other salmonellae by the frequency with which it invades the blood stream, causing a generalized infection, and by its high mortality. Infection may manifest itself in three ways: as a gastro-enteritis, a typhoid-like illness, or a septicaemia. The septicaemia may localize in the lungs, bones, joints, or meninges. Reports of sporadic cases of the generalized type of infection have been published by Harvey (1937). He reviewed the literature, finding 50 cases, and added a further 21 cases. Goulder, Kingsland, and Janeway (1942) reported 11 cases, and Jager and Lamb (1943) six cases. Saphra and Wassermann (1954) analysed 329 cultures of *Salm. choleraesuis* from human sources submitted for identification to the New York Salmonella Center between 1940 and 1954. The organism had been isolated from the blood in 247 instances, and in only 26 from the faeces alone.

In this country only 12 cases of the generalized type of infection have been recorded. Nabarro, White, Dyke, and Scott (1929) and Schwabacher, Taylor, and White (1943) reported two cases each, and single cases were described by Boycott and McNee (1936), Herring and Nicholson (1939), and Guthrie (1941). Five cases of unusual manifestations of *Salm. choleraesuis* were reported in the *Monthly Bulletin of the Ministry of Health* (1950a, 1950b, 1951). These comprise two cases of septicaemia, a septic arthritis, and a cold abscess of the scalp, and in one case the organism was isolated from the urine. No clinical details were given.

During 1923-53 *Salm. choleraesuis* was isolated from 66 food-poisoning incidents in England and Wales out of a total of 14,847 due to salmonella organisms.

The following two cases are put on record because they present features not previously reported in this country.

Case 1

A personnel manager in a bakery firm, aged 53, was admitted to Sefton General Hospital on December 16, 1954, with a history of an influenza-like illness and backache one month earlier, followed by swelling of his ankles. There

was no history of gastro-enteritis, but three months previously, in the course of his work, he had been in contact with the contents of a large tin of ham which was obviously decomposed and was in fact condemned, although no record of a bacteriological examination is available.

On admission his temperature was normal. Oedema of the ankles and sacrum was present, but no cause for this could be found. Three days after admission he had a temperature of 100-104° F. (37.8-40° C.). Four blood cultures were taken over a period of 24 hours, and an organism of the salmonella group was isolated from three. These were identified by Dr. Joan Taylor at the Salmonella Reference Laboratory as *Salm. choleraesuis* var. *kunzendorf*.

The patient was transferred to Fazakerley Hospital on December 24. He was treated with chloramphenicol, 500 mg. six-hourly for seven days. His temperature settled. On January 8, 1955, he complained of pain in the right loin and dysuria. *Salm. choleraesuis* was cultured from the urine. On January 14 he was again pyrexial, and on January 26 a further course of chloramphenicol, 500 mg. six-hourly for seven days, was started. His temperature settled. An intravenous pyelogram showed normal excretion of the dye.

On February 19 he complained of pain in both loins and was found to be tender over the lower dorsal vertebrae. X-ray examination of the spine showed diminution of the disk space between D9 and 10 with erosion of the adjacent vertebral margin and a paravertebral abscess, presumably due to *Salm. choleraesuis*.

Stools cultured 23 times between December 25, 1954, and March 3, 1956, failed to grow *Salm. choleraesuis*. The urine was frequently cultured, and was found to be sterile except on January 8.

The patient was eventually discharged from hospital on November 16, 1955, wearing a spinal support. The stools of relatives were examined but no carrier was found.

An x-ray film taken on August 21, 1956, showed the destructive lesion between the ninth and tenth dorsal vertebrae to be healed. There was very little destruction in these two vertebrae, but the intervertebral disk had been destroyed. The paravertebral abscess had almost disappeared. He was still wearing a surgical support.

Case 2

A woman confectioner aged 23, suffering from idiopathic thrombocytopenic purpura, was admitted to Sefton General Hospital for splenectomy on February 1, 1955. There had been no history of gastro-enteritis, and a chest x-ray examination showed the lung fields to be clear.

Splenectomy was performed on February 11, using a trans-thoracic approach through the bed of the tenth rib, and the chest was closed without drainage.

On the second post-operative day the patient became febrile. A chest x-ray film showed a left basal opacity. She was treated with penicillin, 500,000 units six-hourly by intramuscular injection, and her temperature settled slowly. On February 22 she again became pyrexial. On clinical examination there was an impaired percussion note at the left base and air entry was diminished. Chest x-ray examination showed consolidation of the left lower lobe. Penicillin was stopped and chlortetracycline, 250 mg. six-hourly, was given. Chest aspiration carried out three days later produced 3 fl. oz. (85 ml.) of dark straw-coloured fluid. Microscopical examination showed an excess of leucocytes, but the fluid on culture was sterile.

The patient remained pyrexial and exploration of the chest was carried out on March 17. A posterior loculated empyema was found and a drain inserted. An organism of the salmonella group was isolated from the pus. This was identified by Dr. Joan Taylor as *Salm. choleraesuis* var. *kunzendorf*. Treatment was begun on March 19 with chloramphenicol, 0.5 g. four-hourly for eight days. Her temperature settled after six days. An organism of the salmonella group was isolated from the pus draining from the chest on April 4 and 6.

Culture of numerous specimens of faeces failed to grow the organism. Blood cultures taken after the chest exploration also failed to grow the organism.

The drain continued to discharge pus until April 26, when it was gradually shortened. The wound closed at the end of May.

Stools of relatives were examined but no carrier was found.

Discussion

The commonest site for the infection to localize is the lungs, where it may produce a bronchopneumonia, lobar pneumonia, pleurisy with effusion, or an empyema. The organism has been isolated from the sputum and the pleural fluid. Pulmonary involvement occurred in one-third of Harvey's cases and in 32 of Saphra and Wassermann's, and in this country the organism was isolated from the lungs at necropsy in one of the cases of Schwabacher *et al.*

Harvey noted several cases of infection due to *Salm. choleraesuis* occurring post-operatively. It followed such procedures as laparotomy, cystoscopy, antral operation, and drainage of an ischio-rectal abscess. One patient developed bronchopneumonia after laparotomy for myomas of the uterus. The organism in this case was cultured from the blood but not from the sputum.

Localization in bone and joints occurred in 15 of Harvey's cases and in 19 of Saphra and Wassermann's. Two cases have previously been reported in this country; arthritis of the shoulder-joint in an infant 8 months old (Nabarro *et al.*, 1929), and arthritis of the shoulder-joint in an infant 7 months old (Guthrie, 1941).

The mortality is high. In Harvey's series it was 38%. In Saphra and Wassermann's series it was 21%, and they compared the mortality rate with 300 consecutive infections of *Salm. oranienburg* and *Salm. typhimurium*; here it was 4.7% and 4% respectively. There have been five deaths in the seven cases reported in this country.

The organism in both the above cases was sensitive *in vitro* to chloramphenicol, yet sterilization was not achieved by courses of this drug. In Case 1 the blood stream may have repeatedly been reinfected from the osteomyelitis of the spine which possibly was present for some time, although evidence of this was lacking.

American workers have shown that the hog is the main carrier of *Salm. choleraesuis*. Infection is probably acquired through careless handling of contaminated pork or eating it insufficiently cooked. The carrier rate is low compared with other salmonellae. Scott (1940), in this country, isolated 38 strains of *Salmonella* from mesenteric lymph nodes of 1,000 healthy pigs, 10 of these were of the species *Salm. choleraesuis*. A more recent investigation by the Salmonella Subcommittee of the Public Health Laboratory Service (1955) failed to isolate the organism from a large number of samples of bile, liver, mesenteric lymph nodes, and faeces of healthy pigs. It was suggested, however, that the medium used, selenite-F, may not have been the best medium for isolating this organism. The source of the organism in these two cases is not known for certain, but in Case 1 it is reasonable to suppose that infection was acquired by contact with diseased ham.

From the wider aspect it can be seen that in view of the patients' occupations the infections presented a major risk to the public health. It is surprising that no further infections by this organism were notified in Liverpool at this time.

Summary

Two cases of the generalized type of infection with *Salmonella choleraesuis* are reported: one case with septicaemia and osteomyelitis of the spine, and the other with empyema following splenectomy. The high mortality is noted. The source of infection in these two cases is not known.

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REFERENCES

- Boycott, J., and McNee, J. W. (1936). *Lancet*, 2, 741.
Goulder, N. E., Kingsland, M. F., and Janeway, C. A. (1942). *New Engl. J. Med.*, 226, 127.
Guthrie, K. J. (1941). *Arch. Dis. Childh.*, 16, 269.
Harvey, A. M. (1937). *Arch. intern. Med.*, 59, 118.
Herring, R., and Nicholson, W. F. (1939). *Lancet*, 1, 1154.
Jager, B. V., and Lamb, M. E. (1943). *New Engl. J. Med.*, 228, 299.
Monthly Bull. Minist. Hlth (Lond.) (1950a), 9, 156.
— (1950b), 9, 263.
— (1951), 10, 235.
Nabarro, D., White, P. B., Dyke, S. C., and Scott, W. M. (1929). *Lancet*, 2, 868.
Salmonella Subcommittee of the Public Health Laboratory Service (1955). *Monthly Bull. Minist. Hlth (Lond.)*, 14, 132.
Saphra, I., and Wassermann, M. (1954). *Amer. J. med. Sci.*, 228, 525.
Schwabacher, H., Taylor, J., and White, M. H. G. (1943). *British Medical Journal*, 2, 358.
Scott, W. M. (1940). *Proc. roy. Soc. Med.*, 33, 366.

UNUSUAL HAEMOGLOBIN VARIANT IN A GUJERATI INDIAN

BY

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During a survey for haemoglobin D an example of an unusual haemoglobin was discovered. This haemoglobin, which was accompanied by normal adult haemoglobin, moved faster than the latter at pH 8.6 on paper electrophoresis, and its characters are described below.

The subjects surveyed were 326 Indians living in and near Kampala, Uganda, and nearly all were first-, second-, or third-generation immigrants from the Bombay region of India. A few Sikhs and Punjabis were included. Two unrelated subjects were found to exhibit both haemoglobins A and D. It may be mentioned here that this series, added to the 174 persons examined by Jacob *et al.* (1956), brings the total of Uganda Indians examined to 500; and among these the number of examples of haemoglobin D found now becomes four.

The Haemoglobin

One woman (Mrs. L. M.), however, showed the abnormal haemoglobin here described, and it was demonstrated in her blood on two subsequent occasions. Both she and her husband came from Gujerat, north of Bombay. Unfortunately the family is scattered in India, Tanganyika, and Kenya, and it was not possible to examine her husband, parents, brother, or sister. Three children, aged 16, 14, and 13, were examined, and showed normal adult haemoglobin only.

A haemolysate of the washed erythrocytes of Mrs. L. M., prepared without freezing, resolved into two components when subjected to electrophoresis on paper in 0.05 M barbitone buffer at pH 8.6. One of these components, representing 20–25% of the whole, moved more quickly than haemoglobin A, its separation being slightly less than that

Paper electrophoretic pattern, at pH 8.6 in barbitone buffer, of the new haemoglobin and haemoglobins A and S.