The serum cholesterol affords an approximate indication of thyroid status, but seems liable to unaccountable fluctuations.

It is a pleasure to thank Mr. A. V. Bridgland, Chairman of the Trustees of the London Clinic, for granting facilities for this investigation. The thyroxine derivative used was generously supplied by Glaxo Laboratories Ltd.

ADDENDUM.—Subsequent to the completion and submission for publication of this paper, further proof of one of our conclusions has been rather strikingly afforded. One of the patients (No. 3) was referred to us for re-examination by her local doctor one year after stabilization on L-thyroxine sodium, 0.5 mg. daily, with the opinion that, clinically, she appeared in need of a higher dosage of thyroxine. Our examination showed her B.M.R. to be well within the normal range (-3), whereas her serum P.B.I. was $13.5 \mu\text{g.}\%$, a distinctly thyrotoxic level. It seems obvious, therefore, that during treatment of hypothyroidism with thyroxine the serum P.B.I. may reach a high level indicative of thyrotoxicosis when no such condition is present clinically, and that a more accurate indication of clinical status is provided by the B.M.R.

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A PERSISTENT URINARY SALMONELLA DUBLIN CARRIER WITH BILHARZIASIS

BY

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Attention has recently been drawn to the prevalence in Egypt of urinary typhoid and paratyphoid carriers (Morton, 1949; Neva, 1949; Walton, 1949; Archer *et al.*, 1950). Their importance to the public health is attested by the fact that at least one large outbreak of typhoid among British Service men in the Suez Canal zone has been attributed to an Egyptian urinary excretor of typhoid bacilli (Anderson and Richards, 1948).

In a collaborative study with Dr. J. Weir, representative in Egypt of the Rockefeller Foundation, 53 native urinary salmonella carriers have been followed up for over a year. The distribution of these carriers by salmonella types, when they were originally detected, was as follows: 28 *Salm. typhi*, 13 *Salm. paratyphi A*, 2 *Salm. paratyphi B*, 9 *Salm. paratyphi C* (or group C), and 1 *Salm. dublin*. Some of the temporary carriers later acquired a urinary or faecal species of salmonellosis different from the original infection.

That the series should contain a carrier who has continued to excrete *Salm. dublin* in his urine for over a year seems worthy of record, because this organism is a common cause of disease in man and animals in many parts of the world, but does not appear to have been isolated in Egypt before. Cattle are apparently the main reservoir of infection and the usual source of the human disease, but the present case indicates that the human carrier may play a more important part in the dissemination of *Salm. dublin* infection than has hitherto been thought.

Case Report

This man, an agricultural labourer aged about 35, was found in a bacteriological survey of the general population of a Nile Delta village, where the urinary enteric carrier rate among men, women, and children was 3% (Miller, 1949). He is physically fit, and his only admitted incapacitating illness was one month's "fever" about 10 years previously. He had been passing blood in his urine for 15 to 20 years, but this did not trouble him and he had never sought treatment for schistosomiasis. His youngest child died of "enteritis" at the age of 1 year, but there was no other history of serious family illness. All of 18 specimens of urine examined at more or less regular intervals from November, 1949, until March, 1951, produced a heavy growth of a non-lactose fermenting organism when plated directly on Difco SS agar.

The Organism.—All isolates were actively motile Gram-negative bacilli which fermented glucose, ~~nitrate~~, and dulcify with the production of gas, and caused no change in lactose, sucrose, or salicin. They produced abundant hydrogen sulphide but were indole- and urea-negative and did not liquefy gelatin. They agglutinated strongly in salmonella O serum of group A, to a lesser extent in sera of groups B and D, and not at all in serum of group C; but formalinized broth cultures failed to agglutinate in any of the enteric group diagnostic H sera available in this laboratory. A culture was sent to Commander L. A. Barnes, of the Naval Medical Research Institute, Bethesda, Maryland, U.S.A., who identified the organism as *Salm. dublin*.

Eggs of *Schistosoma haematobium* were found in 16 of the 18 urine specimens, blood in 15, and macroscopic pus in every one. No salmonella or shigella organisms were cultured from 13 stool specimens examined at approximately monthly intervals.

Ten specimens of the carrier's blood were collected during the course of a year. The clots were cultured by a technique known to give a very high proportion of positive results in cases of enteric fever, but all were sterile. The serum specimens were used for agglutination tests. No H agglutinins for typhoid or paratyphoid A were detected; but low-titre (1:5–1:20) H-specific agglutinins for paratyphoid B and C were present in some of the specimens. The typhoid O titre fluctuated between 1:40 and 1:320, and the Vi titre from traces of agglutination at 1:5 or 1:10 dilutions to full standard agglutination at 1:20. The patient's serum invariably agglutinated formalinized broth cultures of his own organism at dilutions varying from 1:640 to 1:2,560.

Comment

The geographical and zoological distribution of the different salmonella species is of considerable interest and of practical importance, because all seem to be potentially pathogenic for man. Although *Salm. dublin* has been isolated from many different animals, it appears to be particularly common in cattle and foxes, being at times the cause of epizootics in their young, with a high mortality leading to serious economic loss. It has been reported as a predominant salmonella type of cattle in Britain, Holland, Finland, Sweden, Australia, South Africa, and South

America; and of foxes in Denmark, Finland, Norway, Holland, and the far west of the United States of America (for references to the literature, see Wilson and Miles, 1946). The apparent absence of this particular salmonella from the extensive eastern and mid-western parts of the United States is quite remarkable (Edwards *et al.*, 1948).

Raw milk from an infected cow is the usual vehicle for human *Salm. dublin* infections, and large outbreaks of food-poisoning from this source have often been reported. Symptoms of the infection vary from a mild gastro-enteritis to a fulminating septicaemia, with a special predilection for fatal meningeal involvement in young children. In Britain *Salm. dublin* has been found more invasive for humans than the other food-poisoning salmonellae (Report of Ministry of Health, 1950). The present carrier had no access to cow's milk; but at the time when he had his bout of fever he was part owner of a water buffalo and customarily drank its milk raw. Since *Salm. enteritidis* (Gaertner) infection of water buffaloes had been described (Wolff, 1930) before this closely related organism was generally differentiated from *Salm. dublin*, they may well be natural hosts, as cattle are, and the patient's febrile episode was perhaps a *Salm. dublin* infection resembling enteric fever, conveyed by buffalo milk, followed by the chronic carrier state. This man's unhygienic family environment emphasizes the possibility that his infant's death at weaning age was due to a *Salm. dublin* infection conveyed from the father.

Chronic human carriers of salmonellae other than typhoid and paratyphoid are relatively uncommon, and those that have been reported were almost invariably faecal. I have failed to find any other chronic human carrier of *Salm. dublin* described in the literature. Ledingham and Arkwright (1912), however, mention two cases of chronic urinary infection with *B. enteritidis* Gaertner, which at that time was indistinguishable from *Salm. dublin*.

ADDENDUM (January 15, 1952).—This man continued to be a profuse urinary excreter of *Salm. dublin* until September, 1951, when he was given 30 g. of chloramphenicol in the course of 10 days. In 100 post-treatment days all of 31 urine and 14 stool specimens have been negative for salmonella organisms, despite uncured urinary bilharziasis.

Grateful acknowledgment is made to Dr. I. Messak, of the Egyptian Public Health Service and Rockefeller Foundation, for invaluable assistance in the collection of specimens and in language interpretation; to J. D. Gilmore, J. E. Samsell, and J. R. Baranski for technical assistance; to Captain J. J. Saperro, U.S.N., Commanding Officer of this Unit, for helpful advice; and to the Medical Director-General of the Navy for permission to publish.

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The Archbishop of Canterbury said at a meeting of the Society for the Promotion of Christian Knowledge in London recently that the rising costs of printing meant that very soon we should become a nation of illiterate people (*Manchester Guardian*, March 7). This was not because we could not read intelligently—though he added that there were not so many who could—but because there would no longer be money left to print anything for people to read. This mounting cost was a real threat to our cultural life.

BALANTIDIASIS IN SOUTH PERSIA*

BY

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Balantidiasis is a rare disease in man, and it is therefore considered that the following 87 cases found in South Persia between April 1 and December 31, 1948, are worth placing on record. The only previous records of balantidiasis in Persia are by Stshensnovitsh (1943) and Selimkhanov (1947).

Local Conditions

The cases occurred among the population of Abadan, an oil refinery town on the island of Abadan, South Persia. This island is situated in the estuary of the Shatt-el-Arab river, at the head of the Persian Gulf, and is some 30 miles (48 km.) long and 5 miles (8 km.) wide at its broadest part. It is a flat desert, with small areas under cultivation. The temperature in winter seldom falls below freezing-point, and the summer shade temperature averages 110–118° F. (43.3–47.8° C.), with usually low humidity. The winter rainfall is about 15 in. (38 cm.). Rain does not fall during the summer.

The population of the town at the time consisted of about 200,000 Persians, 2,000 Indians and Pakistanis, and 5,000 British. About 100,000 of the Persians were either employed in the refinery operated by the Anglo-Iranian Oil Company or were dependants of employees. Much was done by the oil company to control and prevent the spread of disease by providing public lavatories and baths, clean piped water supply, an efficient sewerage system, and collection and disposal of refuse. It was sometimes difficult, however, to persuade the uneducated section of the populace to use these facilities, or to make them realize the value of simple hygiene.

In an effort to reduce the incidence of the dysenteries in Abadan a scheme was instituted on April 1, 1947, by which all artisan employees reporting sick and regarded as cases of dysentery on clinical grounds or from stool examination were admitted to the company's isolation hospital. Any employee found to be a carrier of dysentery was also admitted. This scheme was described by Stewart (1949), and led to the collection of this series.

An excellent account of the pathology, with necropsy reports, and a review of the literature on balantidiasis, is given by Koppisch and Wilking (1947).

Mode of Infection

All patients in this series were Mohammedans. In accordance with their religion they had no contact with pigs, nor did they eat pork. The pig can be excluded as the source of infection. This is in accordance with the conclusion reached by Ostroumov (1947) following examination of pigs and slaughterhouse workers in Soviet Central Asia.

No cysts were found in the stools in the Abadan series, and no source of infection, apart from the human cases, was discovered. Intestinal contents of sheep and cattle killed in the town slaughterhouse were examined, but no balantidia were found. The excreta of goats and samples of river water revealed no balantidia. After this investigation, which ended on December 31, 1948, cases occurred with much less frequency, but all continued to be admitted to hospital for treatment. Dr. I. S. Stewart later informed me in a personal communication that balantidiasis is now rare. A man-to-man transmission of the infection therefore seems to be strongly suggested.

*This paper is condensed from a thesis presented for the M.D. degree of the University of Glasgow, 1950.