height from which it falls should be such that it forms a ring when it enters the fluid. If cups or umbrellae are formed the apparent specific gravities will be higher; if the pipette is not steady fluffy rings will be formed and the apparent specific gravity found will be less.

Summary

The copper sulphate method for measuring specific gravity of serum gives satisfactory and consistent estimates of the protein concentration.

The apparent specific gravities found by this method are less than the true specific gravity.

The equation recommended for calculating the protein concentration from the apparent specific gravity is $P = 364 (S - 1.006)$.

For satisfactory and consistent measurements of serum protein by the Kjeldahl method, selenium dioxide should be used as a catalyst and digestion should be continued for at least one hour, and preferably for $3\frac{1}{2}$ hours.

We wish to express our thanks to Prof. Chibnall for his advice and assistance.

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FOUR CASES OF TYPHUS FEVER IN GREAT BRITAIN

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Typhus fever is rare in Great Britain. From a review of the recent literature on its incidence it would appear that only one case occurring in 1944 has been recorded (Agnew and Kyles, 1944). As several cases of typhus fever are now under treatment in this country, it may prove of interest to report a small series of four patients who developed this disease while in hospital in Bradford. Three of these cases had been under constant medical supervision before the development of the disease, and it has thus been possible to follow the course of their illness from the day of onset.

The four patients referred to in the following report had been released from the same prisoner-of-war camp in Germany, in which, so far as can be ascertained, typhus fever was endemic. They were all disinfested by the routine procedure of insufflation of their clothing by dichlor-diphenyltrichlorethane (D.D.T.) powder on April 26, 1945. They arrived in England two days later and were immediately transferred to hospital, where on admission they were found to be free from lice.

Case I

A man aged 25. His general condition on admission was fairly satisfactory, his weight then being about 14 lb. below his normal. On May 3—i.e., seven days after disinfestation—there was an unexplained rise of temperature to 102°F. , with a pulse rate of 124. Prodromal symptoms were entirely absent, apart from a feeling of "fatigue," which persisted throughout the illness. The pyrexia and tachycardia continued for 10 days and then fell by slow lysis over a period of four days. The total duration of the febrile period was 13 days, and while during this time the patient developed a fairly well marked degree of toxæmia, this at no time gave rise to any anxiety. His mental condition remained fairly normal throughout the illness, and although towards the end of the first and beginning of the second week there was definite mental confusion, there was neither violent delirium nor restlessness. Conjunctival suffusion was present at the start of his illness. The rash, which was reported to be macular in character, developed on the fourth day and showed the typical distribution over the trunk and limbs only. When seen by one of us eight days later it had entirely disappeared. There was no splenomegaly. On the 14th day of the disease there was clinical

evidence of meningism, but lumbar puncture revealed a normal cerebrospinal fluid. The following pathological investigations were made:

- 5th day of disease:
 Widal reaction = Positive agglutination to 1 : 50 against *B. typhosus*
 12th day of disease:
 Weil-Felix reaction: agglutination against OX 19 to 1 : 250
 14th day of disease:
 Weil-Felix reaction: agglutination against OX 19 to 1 : 1000

The patient made an uninterrupted recovery.

Case II

A man aged 44. The general condition of this patient remained satisfactory until May 5—i.e., 9 days after disinfestation—when there was a rise in his temperature and pulse rate to 99°F. and 100 respectively. The next day his temperature had risen to 104°F. At this time the patient had a septic right thumb, which required incision and drainage. From this, the 4th day of his illness, his general condition deteriorated steadily, so that by the 10th day the typhoid state was well established. There was a low muttering delirium, and signs of cardiovascular failure soon became apparent. When seen by one of us on the 12th day he was *in extremis*, and died within 24 hours. On the 6th day a subcuticular mottling appeared over the trunk, together with a petechial rash, which was profuse on both trunk and limbs. On the 10th day the spleen was reported to be slightly enlarged. Conjunctival injection was marked.

Pathological reports included the following relevant findings:—On the 11th day of disease: White blood count, 16,000 per c.mm.—polymorphs, 64%; lymphocytes, 28%; Türck cells, 2%; mononuclear leucocytes, 6%; blood urea, 86 mg. per 100 c.cm. Urine: Albumin ++; a few granular and epithelial casts present. Weil-Felix reaction: Agglutination against OX 19 to 1 : 10,000; against OX 2 to 1 : 50.

At the necropsy all the organs showed evidence of passive congestion. The spleen was normal in size, with soft affluent pulp. There was a diffuse rash over the body, merging with post-mortem lividity. Discrete small macules were present on the trunk, and were profuse on the legs and inner aspects of the arms. A few petechial haemorrhages were also present.

Report on the skin section: In the skin macule the small vessels showed marked congestion, with collections of inflammatory cells (mainly lymphocytes) in and around the adventitia.

Case III

A man aged 25. This patient was discharged home on leave four days after his arrival in England and was readmitted to hospital 12 days later. He stated that for the preceding six days he had been suffering from vomiting and diarrhoea with severe headache and backache, the illness beginning with a shivering attack. The illness commenced 11 days after disinfestation, assuming that the onset dated from this shivering attack. On admission his temperature was 100.6°F. and pulse rate 94. The pyrexia which followed was of an irregular character and reached 104.8°F. on the 9th day of the illness, and there was a tachycardia of 150 on the 11th day. The febrile period continued for 13 days and then fell by slow lysis over 4 days. The rash appeared on the 9th day, and consisted of petechiae, mainly present on the abdomen and legs, but this distribution soon involved the whole trunk and limbs. At this time there was a very well marked conjunctival suffusion. An enlarged spleen was easily palpated and was found to extend two finger-breadths below the left costal margin. During his illness there was a mild toxæmia, accompanied by lethargy and a fine tremor of hands and feet. There was also some mental confusion, most marked at night, but no undue restlessness.

The pathological findings were:—On the 9th day of disease: Blood urea, 90 mg. per 100 c.cm. Urine: Hyaline and occasional granular casts present. Weil-Felix reaction: Agglutination against OX 19 to 1 : 250. On the 16th day of disease the Weil-Felix reaction showed agglutination against OX 19 to 1 : 1000. The patient had a rapid convalescence.

Case IV

A man aged 29. He was a contact of Case I, being a patient on the opposite side of the ward, but as he was ambulant during the early part of the latter's illness a closer contact may have occurred. On the 27th day after disinfestation the patient complained of nausea, fairly severe frontal and occipital headache, and malaise. His temperature and pulse rate in 12 hours rose from normal to 103.2°F. and 96. This rise was followed by a short febrile period of only 5 days, when the temperature was of an irregular character, as in the other three cases. Apart from a mild conjunctival injection, there were no other clinical signs during this man's illness.

Pathological Report.—2nd day of disease: Weil-Felix reaction—positive agglutination against OX 19 to 1 : 50 and against OX K to 1 : 25; 6th day of disease: Positive against OX 19 to 1 : 1000. The patient's general condition remained excellent throughout, and his symptoms rapidly disappeared when his temperature had subsided.

Commentary

Case II suffered from a severe attack of typhus fever, the diagnosis of which appears obvious in retrospect but was rendered difficult at the time by the presence of the septic thumb, which dominated the clinical picture. The continued pyrexia was originally attributed to a septicaemia secondary to the septic focus together with a possible concomitant attack of malaria. That death occurred in this man, who was 44 years of age, confirms the recognized fact that the mortality rate from typhus fever increases with the age of the patient (Mackenzie, 1941).

Cases I and III had fairly mild but typical attacks of typhus fever, although at no period of their illness was the toxæmia profound. These cases also differ from the classical description of typhus fever in that delirium was not pronounced and certainly was not of the dissociation or occupational type.

Case IV presents several interesting features: (a) The first sign of the disease developed 27 days after thorough disinfectionation—i.e., 4 days longer than the recognized limit of the incubation period for this disease (Memo. on Louse-borne Typhus Fever, No. 252, 1941). As already stated, this patient was a fairly close contact of Case I throughout his illness. That Case IV was a secondary infection from Case I is the obvious explanation, but no other secondary cases have occurred either among other patients in the same ward or among the nursing or medical staff. There have been no secondary cases from Cases II and III, which were nursed in different wards from Case I. (b) The attack of typhus fever was of the abortive type, in that the total duration of the illness was only 5 days and in that the classical signs of the disease did not develop as in the other cases. Positive Weil-Felix reactions also occur in undulant fever in titres of 1 in 50 to 1 in 240, but the progressive rise in titre does not (Findlay, 1941). The Weil-Felix reaction in this patient showed a diagnostic rise in titre from 1 in 50 on the 2nd day of the illness to 1 in 1,000 four days later. (c) The early appearance of the positive Weil-Felix reaction on the 2nd day of the illness is uncommon (Felix, 1941). The patient was questioned as to the possibility of previous immunization against typhus fever. The last prophylactic injections he received were in July, 1942, but he is ignorant of their character, and it is impossible to determine this most important point. In the light of this case it is clearly of diagnostic importance to perform a serological examination at the earliest opportunity in any patient suspected of typhus fever. It is recognized that a titre of 1 in 80 to 1 in 100 is necessary before a clinical diagnosis can be confirmed.

Rash.—The typical exanthem occurred in three of these patients and appeared on the 4th, 6th, and 9th days of their illness. It showed the typical distribution of that of typhus fever in that, while absent on the face, it was profuse on the body and limbs, particularly in Cases II and III. The rash was definitely petechial in character, the size of each petechia varying between 1 and 2 mm. in diameter. The colour, originally a bright pink, changed to a dark bluish-red. It did not appear in crops, and persisted distinctly for 3 days in Case III before fading, when it was replaced by a brownish staining which gradually disappeared. The subcuticular mottling described in this disease was widespread on the trunk and limbs in Cases II and III, but this element of the rash faded more quickly than did the petechiae in Case III. Accompanying the rash there was conjunctival suffusion, which was well marked in the first three cases.

Type of Pyrexia.—As can be seen from reference to the accompanying temperature charts, the type of pyrexia is similar in all four cases. The temperature shows a well-marked intermittent and remittent character—a feature which is even more pronounced in the four-hourly charts. Disproportionate bradycardia, as is said to occur in some cases of typhus fever, was not observed in this small series of cases.

Penicillin Therapy.—Penicillin was administered to these patients for prophylaxis against the possible development of the secondary infections which are likely to occur during the course of this disease. Such conditions as bronchopneumonia, septic parotitis, and septic conditions of the skin have been common in the epidemics of typhus fever in Europe (Megaw, 1942). Penicillin was given by three-hourly intramuscular injections of 15,000 units to all four patients, but, as can be seen from the

temperature charts, it was begun at different stages in these cases. In Case I penicillin therapy was started on the 13th day of the disease, when the temperature and pulse rate were already falling by lysis. In Case II the first dose of penicillin was given about 72 hours before death, when the patient was profoundly

Temperature charts of the four cases of typhus fever. The arrows indicate the beginning of penicillin therapy.

toxæmic. Case III received the first injection of penicillin on the 11th day of illness, and in Case IV it was first given on the 2nd day. No attempt is made in such a small series of cases to draw any conclusions on the effect of penicillin on this disease.

Summary

Four cases of typhus fever imported into England by repatriated prisoners of war are described and the important clinical features of each case are briefly reviewed. One patient died, and a note on the post-mortem examination is included. Another of these patients had an abortive attack, the interesting features of which are described in some detail.

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SORE FINGER-TIPS IN INDUSTRY

PROTECTION BY HYDROGEN PEROXIDE

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This is a record of an accidental discovery of a promising method for preventing injury to the skin of the finger-tips by constant friction against a rough surface.

Medway Paper Sacks Ltd., an associated company of Albert E. Reed and Co., paper makers, Aylesford, Kent, is engaged in making large sacks from strong brown paper (kraft). This paper has a rough surface, and the sacks are finished by passing either one end or both ends through a wire-stitching machine. The paper passes through this machine with a rapid jerky motion, and is guided by the operator's fingers. During the whole of an eight-hour day her fingers are rubbing over the rough dry surface of the paper. This amount of friction causes damage to the skin of the finger-tips, and until recently two-thirds of the women working on the stitching machines visited the surgery about once a fortnight for treatment. The remaining one-third were unaffected, although many of them had been on the same work for years. The reason for this has not been discovered; there is no difference in the method of handling the paper.