culosis is most often due to the bovine type of bacillus which is conveyed in milk. The researches of Blacklock and Griffith leave no doubt on this point, as they found the bovine type of bacillus in 80 to 82 per cent. of cases with primary foci in the abdomen. We are therefore entitled to assume that in our cases also the bovine type of bacillus predominated. This assumption is sustained by the fact that a majority of the children came from rural areas where children are more often fed on raw milk.

It may be remarked that in Case III the parents declared that the child had been given only boiled milk. The possibilities in this case are, first, that the infection was of the human type, which is rare; and, secondly, that the milk had been insufficiently or not always boiled. To omit to boil milk properly on a single occasion is quite sufficient to allow the tubercle bacillus to enter the body and give rise to infection.

Conclusions

Primary abdominal tuberculosis is a commoner disease in children than is generally supposed, and the true incidence is much higher than post-mortem figures indicate.

In primary abdominal infection, as in cases with a primary lung infection, the prognosis depends on the age of the child: the younger the child at the time of infection the worse the prognosis.

We are unable to accept the current view that primary abdominal tuberculosis can be more lightly regarded in children than can a primary lung infection: the bad prognosis in young children refutes this view. Diagnosis in cases of primary abdominal tuberculosis in the living child is extremely difficult; consequently early treatment is rarely possible. Prevention of infection is therefore all-important. Many cases of tuberculous meningitis, miliary tuberculosis, and crippling deformities could be prevented. We should endeavour, as an ideal, to secure for children milk from tuberculin-tested herds only, but at present it is impossible to provide this for the whole population. Therefore the greatest measure of protection is afforded by milk which has been boiled or efficiently pasteurized.

We wish to thank Dr. D. N. Nabarro, Director of the Pathological Department, Hospital for Sick Children, for the interest he has taken in our work, and the honorary medical and surgical staff of the hospital for permission to use their case reports and post-mortem records.

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The regulations governing the award of Commonwealth Fund Fellowships have been amended since the publication in the *Journal* of October 15 (p. 804) of the announcement regarding the fellowships. The chief alterations are as follows: Candidates must be unmarried and must not have attained the age of 30 on September 1 of the year of award; fellowships are vacated by marriage; they are open to men only; and are tenable for two years. Readers of the *British Medical Journal* who are interested are advised to apply to the secretary of the Commonwealth Fund Fellowships, 35, Portman Square, W.1, for copies of the revised regulations.

APLASTIC ANAEMIA WITH COMPLETE RECOVERY

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When treating a patient with aplastic anaemia it is difficult to decide as to how long it is worth while keeping him alive by repeated blood transfusions in the hope that his bone marrow will ultimately revive and so maintain his cure. There are types of so-called idiopathic aplastic anaemia in which the bone marrow fails to recover and the disease is progressive and fatal. Blood transfusion probably does no more than postpone their death by a few months. There are other types of aplastic anaemia, usually the result of poisoning by drugs, in which the bone marrow quickly recovers its function and effects an automatic cure with or without the aid of a few blood transfusions. It is between these extremes that we are faced with the difficulty of deciding the number of transfusions to be given.

The case whose story is reported here is that of a man with aplastic anaemia following salvarsan therapy who in 1935 was kept alive for nine months with blood transfusions and is now (three years afterwards) in good health. At first no history of treatment by salvarsan was obtained, and in the absence of any apparent exposure to a noxious drug he was regarded as suffering from idiopathic aplastic anaemia. With the haemoglobin falling to 18 per cent. and the patient almost blind from retinal haemorrhages, there appeared to be no hope of recovery. He continued in this state for five weeks while transfusions were given to him two or three times weekly. In all, twenty-five transfusions were given in nine months.

Case History

The patient, a confectionery baker aged 50, began to complain of lack of energy and shortness of breath on exertion, and in April, 1935, his friends noticed that he was getting pale. A blood count done at that time showed 50 per cent. haemoglobin with colour index 1.1, and in spite of intensive oral and intramuscular liver therapy his condition rapidly became worse. He was first seen in May, and was admitted to hospital on the 30th of that month. He was then in a very critical condition, with dyspnoea on the slightest exertion. His mental processes were distinctly sluggish, his manner morose, and the history was given in a distant and hesitant manner which did not lead one to place much reliance on his statements. There were widespread haemorrhages into the skin and mucous membranes, and these were so thickly scattered in the retina that he was scarcely able to see. There were a few superficial ulcers with their sloughs on the buccal surface of the lower lip. Apart from some distension of the bladder, which could be palpated without discomfort, and absent ankle-jerks, examination was negative. The Wassermann reaction was very weak positive, and the van den Bergh normal, and radiographs of the femora revealed no encroachment on the medulla.

A blood examination resulted as follows: red cells, 1,380,000; haemoglobin, 23 per cent.; colour index, 1.02; reticulocytes, 0.6 per cent. The red cells were normal in shape, size, and colour. There was a slight amount of anisocytosis, but no poikilocytosis or polychromatophilia. No early forms were seen. Platelets numbered 38,600 (over 500 erythrocytes), and the white cells 2,187. The differential count showed: polymorphs, 16 per cent. (350 per c.mm.); lymphocytes, 72 per cent. (1,575); monocytes, 9 per cent. (197); eosinophils, 1 per cent. (22); basophils, 1 per cent. (22); myelocytes, 1 per cent. (22). The lymphocytes were mainly large in character. No primitive forms were seen. The

Arneth count over 16 polymorphs showed a slight shift to the left: young forms, 5; 2 lobes, 9; 3 lobes, 2.

The patient's doctor was unaware that the man had ever had any serious illness or any treatment during the few years he had known him, and the patient was unable to give any reliable evidence regarding himself. It subsequently transpired that in 1926, when living elsewhere, he sought medical attention for incontinence of urine, and was found to have a positive blood Wassermann reaction. He received treatment during the subsequent four and a half years, at the end of which time he was discharged symptom-free but with the Wassermann reaction still positive. Details of treatment before July, 1928, are not available, but subsequent to that date he received three doses of 0.45 gramme of N.A.B., four of 0.6 gramme of N.A.B., six of 0.6 gramme of stabilarsan, and thirty-eight of 1 grain of mercury.

In July, 1928, symptoms returned, and treatment was resumed, being continued until December, 1934. During this time he received four doses of 0.45 gramme and five of 0.6 gramme of N.A.B. Jaundice then developed, and no treatment was given until March, 1935, from which date to the onset of symptoms six doses of 0.45 gramme of N.A.B. were administered, with no apparent ill effects other than slight loss of weight.

On account of the patient's condition on admission and a further fall of haemoglobin to 18 per cent. and red cells to 750,000 in the next week in spite of 18 oz. of blood being received as three transfusions, a hopeless prognosis was given. Intramuscular injections of pentose nucleotide were without effect on the white cell count and were soon discontinued, as the patient complained bitterly of pain at the site of injection. It was decided to see if recovery of the bone marrow would occur with the blood at a higher level, and accordingly ten transfusions of up to one pint were given in the next four weeks. During this period a remarkable change took place in the patient's mental and physical condition. He became cheerful and jocular, was able to get up and go about in comfort, and vision was restored to normal. No haemorrhages were now visible in the retina, and the blood count was as follows: red cells, 4,320,000; haemoglobin, 68 per cent.; reticulocytes, 0.6 per cent.; white cells, 4,375; polymorphs, 12 per cent.; lymphocytes, 84 per cent.; monocytes, 4 per cent.

At no time during this period did the reticulocytes exceed 1 per cent. The patient was discharged with instructions to take things very quietly and avoid physical exertion. One month later the haemoglobin fell to 38 per cent., but he still felt fairly well, and was able to carry out light supervisory work. Regular transfusions of one pint at intervals of three weeks were begun, and by this means haemoglobin was kept in the region of 50 per cent. He was transfused as an out-patient, and no untoward reactions were experienced, except on one occasion when loss of consciousness and an epileptiform convulsion occurred towards the end of a transfusion. The patient was then admitted for a few days, and an itching urticarial rash appeared three days after the transfusion. The blood was from a donor who had been used three months previously, and had been given at the same rate and in the same manner as on other occasions—citrate blood through a No. 12 hypodermic needle with a two-way syringe. The blood of two polycythaemic patients with haemoglobin 130 to 140 per cent. was used on several occasions, but had to be diluted with saline to facilitate passage through a No. 12 needle.

Throughout this period the red blood cells showed a good deal of anisocytosis and the colour index remained high. At no time did the reticulocytes exceed 1 per cent. Platelets were about 40,000; the white blood cells were 1,500 to 4,000, with polymorphs less than 20 per cent. and many of them bilobed.

In March, 1936, owing to thrombosis of his only good vein and increasing difficulty in using the small superficial ones, it was decided to see if he could maintain himself at a low level. At first a slight fall occurred, but after several weeks the haemoglobin began to rise at the rate of 2 to 3 per cent. a week. Reticulocytes varied from 2 to 6.3 per cent.

In April, 1937, the count was: red cells, 4,110,000; haemoglobin, 99 per cent.; colour index, 1.2; white cells, 7,700. In August, 1937, it was: red cells, 4,880,000; haemoglobin, 105 per cent.; colour index, 1.07; white cells, 6,000; platelets, 214,000; polymorphs, 25 per cent.; lymphocytes, 52 per cent.; monocytes, 2 per cent.; basophils, 1 per cent. Undifferentiated, 18 per cent.; myelocytes, 2 per cent.; the red blood cells showed moderate anisocytosis.

When last seen, on December 28, 1937, the patient appeared quite normal, had had no further nervous symptoms, and the blood count was as follows: red cells, 4,600,000; haemoglobin, 92 per cent.; reticulocytes, 0.4 per cent.; white cells, 6,800; platelets, 370,000. At the present date he is known to be still well and at work.

Commentary

A case showing marked diminution in all the cellular elements of the blood following considerable arsphenamine therapy is recorded. Fortunately the anaemia due to aplasia in this case was not increased by haemorrhage from the mucous membranes, as seen in a recent case of aplastic anaemia due to gold therapy for rheumatoid arthritis in which a fatal haematemesis occurred.

Despite a fall to 18 per cent. haemoglobin and 750,000 red cells recovery has occurred, and the patient is apparently normal more than two years after the last transfusion.

In the cases reviewed by McCarthy and Wilson (1932) that with the lowest level—one million—recovered, as did Imrie's (1935) case with 840,000 red cells and 17 per cent. haemoglobin. The former authors concluded that the drug and dose used made little difference to the prognosis, but the shorter the period between the last dose and the onset of symptoms the better the outlook. The thirty-four cases they described and collected from the literature showed a mortality of 83 per cent.

During the period that the blood level was kept up by transfusions there was no evidence of spontaneous recovery, the haemoglobin always being about 40 per cent. immediately before and 50 per cent. immediately after a transfusion.

Within a few weeks of ceasing transfusions there was an increase of reticulocytes and a gradual rise of red cells. The colour index remained high until a normal level was reached, and granulocytes lagged behind in their recovery.

There seems no doubt that without repeated transfusions the case reported would have rapidly proved fatal.

In all 418 oz. of blood were given as twenty-five transfusions.

I am indebted to Dr. J. C. Spence for allowing me to treat this case and for many helpful suggestions.

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All applications for fellowships in connexion with the Finney-Howell Research Foundation must be filed in the office of that Foundation, 1211, Cathedral Street, Baltimore, Maryland, U.S.A., by January 1, 1939; the awards will be announced on March 1. This Foundation was created to intensify research into the cause or causes of cancer and its treatment. Ten such fellowships were awarded in 1938; each carries an annual stipend of 2,000 dollars, and may be renewed in two successive years. Applications are to be made on the forms supplied by the secretary of the Foundation at the above address.