

pain, and vomiting. This type is much less dramatic in its presentation and resolves spontaneously. Unless a radiograph taken during an attack shows jejunum lying within the stomach the diagnosis can never confidently be made. This was however achieved in the cases reported by Chamberlin (1940) and Sibley (1944) and in both instances the intussusception had reduced itself by the time laparotomy was undertaken. In the present case the two previous attacks and the readiness with which the intussusception could be reduced and reproduced at operation lead one to suppose that it was an 'acute on chronic' intussusception and the absence of vomiting was due to the fact that the condition had not long been present.

Urgent operation is imperative as soon as the patient has been made fit to withstand it. Resection of a gangrenous intussusceptum may be required but apart from this all that is necessary is reduction of the intussusception. Recurrence is a matter of the very greatest rarity and in two reported cases (Burdman, 1954; Douglas, 1954) recurrence had taken place despite measures that were taken on the first occasion to prevent it. The greatest service that the surgeon can render to his patient is to recognise the condition at the outset and not to prolong the operation by trying to prevent what will probably never happen again.

My thanks are due to Mr. Norman Tanner for permission to report this case.

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A CASE OF APLASTIC ANAEMIA TREATED BY ISOLOGOUS BONE MARROW INFUSION

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JACOBSON and his colleagues have shown in a series of most elegant experiments that shielding part of the haemopoietic tissue during irradiation, or the post-irradiation implantation of healthy isologous haemopoietic tissue will restore the bone marrow cellularity of irradiated animals (Jacobson and Simmons, 1948; Jacobson, Marks, Gaston, Robson and Zirkle, 1949; Jacobson, Marks, Robson, Gaston and Zirkle, 1949; and Jacobson, Simmons, Marks, Robson, Bethard and Gaston, 1950). These observations were extended by Lorenz and his co-workers, when it was demonstrated that the intravenous infusion of viable isologous marrow cells prevented the death of lethally irradiated mice and guinea pigs (Lorenz, Uphoff, Reid and Shelton, 1951). Attempts to use homologous instead of isologous marrow soon

revealed difficulties and dangers inherent in the transfer of cells between genetically distinct animals; the homologous marrow proved to be less effective (Lorenz, Congdon and Uphoff, 1952) and it frequently produced secondary disease (Barnes and Loutit, 1954; Mathé, Bernard, deVries, Schwarzenberg, Larrieu, Lalanne, Dutreix, Amiel and Surmônt, 1960). It is not surprising, therefore, that when marrow infusion techniques come to be applied in clinical medicine, great interest should be given to those circumstances where the experimental isologous situation can be duplicated in man, that is, where an identical twin can be used as the marrow donor. In addition, it was a logical extension of the radiation protection work to attempt to treat the bone marrow aplasia of disease states by isologous marrow

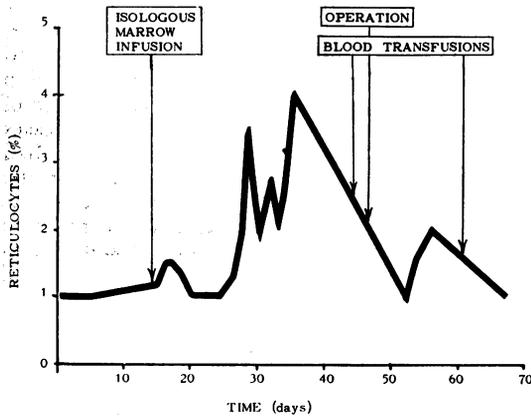


FIG. 1.—Reticulocyte counts following isologous marrow infusion.

infusions. Obviously, such situations are very rare, but no less than ten isologous marrow infusions have been reported; 7 were patients suffering from leukaemia (Atkinson and Mahoney, 1958; Atkinson, Mahoney, Schwartz and Hesch, 1959; Atkinson, 1960; Aleksandrowicz and Blecharski, 1960); 1 was a patient with disseminated seminoma (Kurnick, 1962) and 2 were cases of aplastic anaemia (Trentin, 1960; Robins and Noyes, 1961). In this paper we describe a third case of aplastic anaemia treated by an isologous marrow infusion.

Case Report

The patient, a 54-year old male, was admitted to the Royal Free Hospital with a two-year history of progressive lassitude and weakness; more recently he developed increasing pallor and had been confined to bed for the last two months. The patient had been treated by a Christian Science practitioner until one week before admission when a general medical practitioner was called in; he administered 750 μ g. Vitamin B₁₂. There was no history of any other medication.

On examination the patient was found to be semi-conscious and on the verge of cardiac decompensation with marked air hunger; the jugular venous pressure was raised and there was moderate liver enlargement with marked liver tenderness, but no oedema. The blood pressure was 100/50 mm Hg. The patient was obviously grossly anæmic, but there was no neurological dysfunction. The hæmoglobin level was 1.5 g./100 ml. (10%), and the reticulocyte count was 2%, which gave an absolute count of 7,500/cu.mm. Cline and Berlin (1963) have shown that a reticulocyte level of 40,000/cu.mm. forms a satisfactory division between normal and subnormal erythropoiesis, and consequently this patient's erythroid activity was very much reduced. The leucocyte count was 15,300/cu.mm. with a normal differential. A sternal bone marrow aspiration produced fatty marrow particles containing relatively few marrow cells and a notable paucity of erythrocyte precursors. There was evidence of rapid discharge of myeloid cells and megakaryocytes were numerous with normal thrombopoiesis. The patient was also found to be suffering from prostatic hypertrophy with retention of urine. The blood urea was 45 mg./100 ml. A provisional diagnosis of aplastic anaemia, possibly of the pure red cell aplasia type was made. During the first

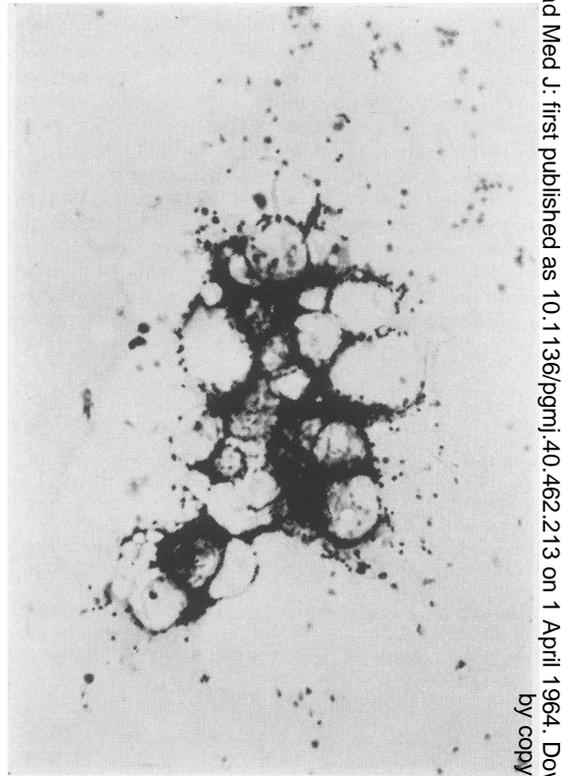


FIG. 2.—Smear of bone marrow cells aspirated before and (b) three weeks after isologous bone marrow infusion (May-Grunwald-Giemsa stain).

three days transfusions of packed red cells from 1.6 l. of blood were given, and this raised the hæmoglobin level to 6.1 g./100 ml. (42%). During the second week a radio-active iron study revealed a plasma clearance half-time of 315 minutes (normal = 70-140 mins.) and the surface counting pattern fully confirmed the diagnosis of red cell aplasia. There was no radiological evidence of a thymoma. Treatment was instituted with Vitamins C and B₁₂, pyridoxine and methyl testosterone, but after two months no evidence of response was observed. Further blood transfusions amounting to a total of 3.2 l. raised the hæmoglobin level to 11.4 g./100 ml. (78%).

The patient was known to have a twin brother; their appearance was similar and it was known that as children they were indistinguishable. Details of placental anatomy were not available and the presence of large numbers of transfused erythrocytes in the patient's circulation rendered proof of identity by means of blood group antigen studies impossible; however, blood typing was carried out by Dr. A. E. Mourant, and the results did not eliminate the possibility of identity. In view of the severe nature of the patient's illness, it was decided to accept the evidence favouring identity and proceed with an isologous marrow infusion without further delay.

Bone marrow was collected from the healthy twin by aspiration from the sternum and pelvis using the technique already described (Pegg and Kemp, 1960). The infusion was given by the intravenous route immediately after centrifugal separation of the fat supernatant fluid. The total number of nucleated cells

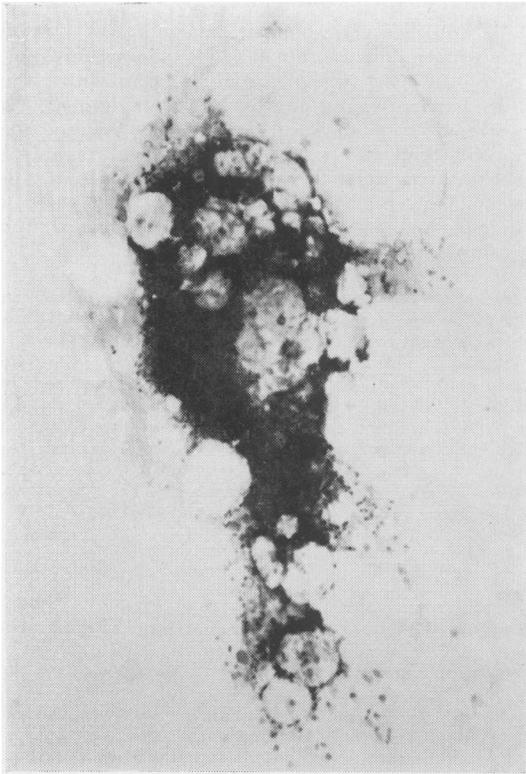


FIG. 2 (b).

was unchanged for 10 days and then a rise in the reticulocyte count occurred, reaching 4% (120,000/cu.mm.) on the 22nd day (Fig. 1). Since all the reticulocyte counts were derived from a scan of 1,000 consecutive red cells, this increase is significant at the 5% level. At this time a sternal marrow aspiration produced many particles with an increase in activity spread throughout the cell types and notably including a marked increase in erythropoietic activity (Fig. 2). However, further radioactive iron studies failed to demonstrate any improvement. At this time the patient was well enough to tolerate the prostatectomy, which was carried out by Mr. J. P. Hopewell. 0.8 l. of blood were transfused three days before and a further 1.2 l. during the operation. Four days after the operation the reticulocyte count was found to have fallen to 1.0%, but within four more days it had risen to 2.1%. The patient was discharged home 7 weeks after the marrow infusion and since then has been studied for rather more than a year. His blood transfusion requirements during this period have amounted to 11.6 litres; transfusions every 6-8 weeks have kept his hæmoglobin level in the range of 8-12 g./100 ml. (55-82%) (Fig. 3).

Discussion

The patient showed a considerable reticulocyte response following the marrow infusion and this occurred at roughly the expected time. However, the reticulocyte count then fell following a large blood transfusion, and although there was a second reticulocytosis, this too fell after a further blood transfusion. The bone marrow cellularity was improved three weeks after the infusion, but did not return to normal, and during the subsequent year the patient's blood transfusion requirements were considerable. We conclude that although

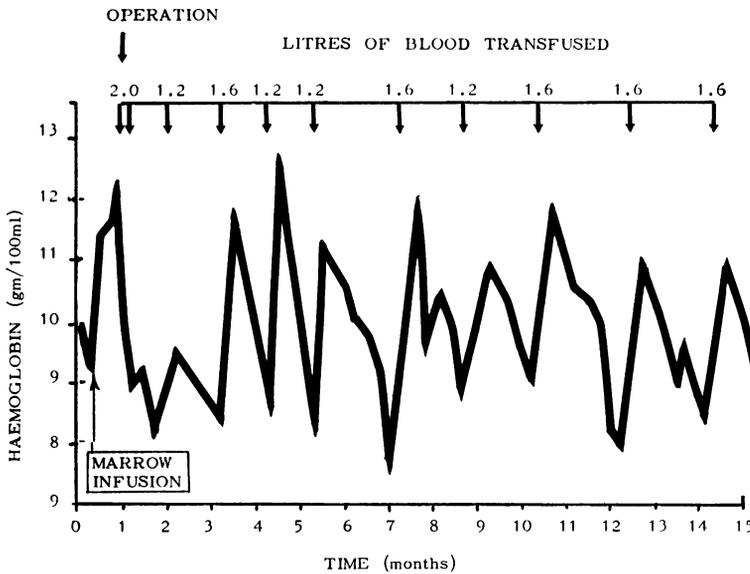


FIG. 3.—Hæmoglobin levels following isologous marrow infusion.

obtained was 8.1×10^9 , with an estimated 4.8×10^9 marrow cells. This provided an infusion of 71×10^6 marrow cells/kg., which, on the basis of animal experiments, should be adequate for isologous infusion in man (Pegg, 1962).

Following the marrow infusion the patient's condition

the initial effect on the reticulocyte count strongly supports the contention that the infusion had some effect, it is equally clear from the long-term result that the procedure was not curative.

The two previously published cases of aplastic

anaemia treated by isologous bone marrow infusions differed in that both were children and the disease was probably drug-induced. The first case, briefly reported by Trentin, failed to respond significantly to two marrow infusions, but Robins and Noyes' case showed a gradual improvement in the reticulocyte count followed by a return to normal. Although this case appears to be quite impressive, the variability of the natural history of this form of aplastic anaemia makes interpretation very difficult. In Trentin's case it seems that there was an abnormality in the 'marrow environment' rather than in the actual bone marrow cells, and there is even more striking evidence favouring such an interpretation in our case. The infused marrow proliferated initially, but for some reason failed to establish itself. The possibility of splenic or thymic inhibition must be considered; in this case there is no suggestive evidence, but it looks as if some environmental abnormality is the primary cause of the disease.

Summary and Conclusions

An adult case of aplastic anaemia was treated with an isologous (identical twin) marrow infusion. There was evidence of initial proliferation of the infused marrow, but this was not maintained. It is argued that such an occurrence favours the concept that the environment rather than the bone marrow cells themselves are at fault in this case. However, the marrow infusion was without side effects and would probably be worth repeating in similar circumstances.

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