INTERMITTENT HAEMODIALYSIS WITHOUT ROUTINE BLOOD TRANSFUSIONS

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In October, 1966 it was decided to try to discontinue routine blood transfusions in our patients on intermittent haemodialysis. This paper describes the results of this policy.

PATIENTS AND METHODS

There were 23 patients. Four of them had had bilateral nephrectomy. Four of the six women had undergone an artificial menopause by selective irradiation of the ovaries for menorrhagia. Of the other two women, one was menstruating normally and one had had a hysterectomy before starting dialysis. The dietary allowance of protein was 40-60 g per day (0.7-0.9 g/kg). The plasma urea and creatinine before each dialysis were 100-150 mg/100 ml and 10-14 mg/100 ml respectively, and 20-60 mg/100 ml and 4-5 mg/100 ml after dialysis. Vitamin supplements which did not contain folate or cyanocobalamin were given to all patients. Androgens and cobalt chloride were not given.

None of the patients showed the characteristic appearances of the under-dialysis syndrome. All of them put on weight after starting dialysis. Dialyses were performed twice a week for 14-16 hr. with a double layer Kiil kidney using Cuprophane membranes PT150. In order to minimise blood loss the kidney was tipped into the vertical position 30 min. before the end of dialysis and rinsed with 1 litre of saline. With this method the blood remaining in the kidney averaged 20 ml per dialysis with a range from 5-50 ml. In addition, a total of 40 ml of blood was taken each month for sampling. Total blood losses therefore averaged about 200 ml per month.

Packed cell volume was measured each week by a micro-method. Serum folate and cyanocobalamin were measured by the methods of Waters and Mollin (1961) and Rosenthal and Sarret (1952) respectively. Serum iron, total iron binding capacity and percentage saturation were measured by the method of Trinder, 1956. Bone marrow aspirate was stained for iron with Perl's iron stain. The lower limit of normal according to Dacie (1953) is 25 to 30 iron-staining granules/100 red cell precursors.

RESULTS

Transfusion requirements

The number of transfusions given and the packed cell volume of the patients for the periods January to October, 1966 and October, 1966 to May, 1967 are given in Table I.

January to October, 1966

This was the period before an attempt was made to discontinue routine transfusions. Twelve patients were treated for 90.5 patient months. It was the practice to transfuse the patients whenever their packed cell volume fell below 25%. During this time 234 units of
TABLE I

<table>
<thead>
<tr>
<th></th>
<th>Jan. '66 to Oct. '66</th>
<th>Oct. '66 to May '67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Patient months</td>
<td>90.5</td>
<td>121</td>
</tr>
<tr>
<td>Units</td>
<td>234</td>
<td>55</td>
</tr>
<tr>
<td>PCV</td>
<td>24.9</td>
<td>20.2</td>
</tr>
<tr>
<td>Units per patient month</td>
<td>2.6</td>
<td>0.5</td>
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blood were required to keep an average packed cell volume of 24.9%. The rate of transfusions was therefore 2.6 units per patient month.

By the end of October six patients had been dialysed for more than 12 months while the others had only been dialysed for 4-10 months. The transfusion requirements of these two groups were the same.

October, 1966 to May, 1967

During this time 23 patients were treated for a total of 121 patient months. Transfusions were only given to replace acute blood losses or when there were symptoms attributable to anaemia. Fifty-five units of blood were given and the average packed cell volume during this period was 20.5%. The average transfusion rate was therefore 0.5 units per patient month.

After October, 1966 the blood requirements of the patients followed one of three patterns. Some patients did not need any blood, others needed some only to replace acute losses of blood, while the remainder continued to need routine transfusions.

No transfusions required (Fig. 1)

There were nine patients in this group. After stopping transfusions in October there was an initial fall in packed cell volume for about three weeks. Packed cell volume then levelled out to approximately 20%.

Four of the patients in this group were started on intermittent haemodialysis during or after October. For the first three weeks of dialyses these four patients showed a marked fall in packed cell volume followed by a gradual rise to a final level below that which they had had before starting dialysis.

Replacement transfusions

There were seven patients in this group. Transfusions were only given to replace acute blood losses such as those associated with bilateral nephrectomy, bleeding during hepatitis, severe menorrhagia and a disconnected blood line. The number of transfusions per patient varied from 1 to 10 units in the 6-month period.

Maintenance transfusions (Fig. 2)

The seven patients in this group needed routine transfusions to prevent their suffering from symptoms of anaemia. In general such symptoms appeared when the packed cell volume fell below 15%.

Two of these patients who started intermittent haemodialysis after October, 1966 only needed 2-3 units of blood during the first few weeks of dialysis. They were then able to maintain a packed cell volume of between 18 and 21% without further transfusion.

The other five patients needed 1 unit of blood per month throughout the 6-month period.
Iron metabolism

The serum iron varied between 55 µg/100 ml and 220 µg/100 ml; the iron binding capacity between 80 and 260 µg/100 ml; and the saturation between 40 and 85%. The number of iron staining granules per 100 red cell precursors in the bone marrow aspirate at the time the serum iron was measured varied between 0 and 306; only four patients had less than 30. The relation between the serum iron and the number of iron staining granules in the bone marrow is illustrated in Fig. 3. The correlation between serum iron and the number of iron staining granules in the bone marrow was not sufficiently close for the serum iron to be of help in
assessing the bone marrow iron in any individual with a serum iron below 100 μg/100 ml.

Two of the four patients whose bone marrow contained less than 30 granules/100 red cell precursors were given oral iron. Within four weeks the number of granules in their bone marrow had risen from less than 3 to more than 20. There was no change in PCV.

![Graph of serum iron and bone marrow Fe granules per 100 cells](image)

*Fig. 3.* Serum iron plotted against iron staining granules per 100 red cell precursors in 23 patients on intermittent haemodialysis. The vertical line at 30 granules indicates lower limit of normal (Dacie, 1953).

**Serum concentration of cyanocobalnine and folate**

The serum cyanocobalnine was normal, ranging from 240 to above 400 μg/ml.

The serum folate in 21 patients was normal, ranging from 5.5 to 50 μg/ml. In the other two patients it was 3.75 and 1.75 μg/ml. These two patients were given folate by mouth. Within a few weeks the serum levels of both patients had risen to more than 7 μg/ml. There was no change in packed cell volume.

**DISCUSSION**

It is clear that most of the patients whom we were treating with intermittent haemodialysis did not need routine blood transfusions. It is unlikely that this would have been possible without having reduced routine blood losses to a minimum.

The greatest potential loss of blood is the amount which remains in the kidney at the end of dialysis. With a good kidney this can be less than 5 ml of blood per dialysis. It is also important to reduce the amount of blood taken for routine biochemical and haematological investigations. In our patients the packed cell volume was estimated once a week and biochemical estimations once a month. Menorrhagia was treated by selective irradiation of the ovaries and acute blood losses were immediately replaced.

Even if blood losses are reduced to a minimum it is probable that patients on intermittent haemodialysis will eventually become iron deficient. Nevertheless, 19 of the 23 patients had
normal or increased iron stores in the bone marrow. These 19 patients had all had multiple transfusions or had been given iron. Some of these patients had received so many transfusions that even if an allowance is made for a rate of blood loss of 200 ml a month, they are unlikely to develop iron deficiency in less than 10 years.

The four patients whose bone marrows were depleted of iron had never been transfused or given iron. It is interesting, however, that in these four patients there was no evidence that their anaemia was due to iron deficiency. Their red cells were normocytic and normochromic; their iron binding capacity was low with a high percentage saturation, in direct contrast to iron deficiency anaemia; they were able to maintain a packed cell volume without transfusion which was in the same range as those patients who had normal or increased iron stores in the bone marrow (one of these four patients had the highest packed cell volume of all 23 patients); and the anaemia did not respond to the oral administration of iron (600 mg/day) in spite of evidence that it was absorbed. Even though the administration of iron did not improve the anaemia, it would seem reasonable to give iron by mouth to a patient whose bone marrow is depleted of iron.

On starting intermittent haemodialysis the packed cell volume always fell. This unexpected finding may have been due to an increased destruction of red cells caused by their passage through the dialyser.

Two of the four patients who had had bilateral nephrectomy were among those who needed routine maintenance transfusion. One of the other two has only been able to maintain a packed cell volume of 17. It has not been possible to determine the maintenance requirements of the fourth patient for she has needed several transfusions for acute blood loss.

Summary

In October, 1966 an attempt was made to discontinue routine blood transfusions in 23 patients on intermittent haemodialysis.

The rate of transfusions fell from 2.6 to 0.5 units per patient month.

Sixteen of the 23 patients have not required routine blood transfusion.

Four patients were found to have low iron stores. They were the only four who had not been given iron or multiple blood transfusions. There was no evidence that the anaemia even in these four patients was due to iron deficiency.

REFERENCES


