

BLOOD AND PLASMA TRANSFUSIONS IN SEVERE ANAEMIAS IN PREGNANCY

by

S. N. UPADHYAY, M.D. (Pat.), M.R.C.O.G. (Lond.),

Head of the Department of Obstetrics & Gynaecology,

P. W. Medical College, Patna

and

BIMAL PRAKASH, M.S. (Pat),

Department of Obstetrics and Gynaecology,

P. W. Medical College, Patna

In respect of the modern blood transfusion services the medical science owes much to the obstetricians. James Blundell, a British obstetrician, was the first to employ the present rational blood transfusion technique. This was soon followed by Braxton Hicks, yet another obstetrician, who introduced a number of improvements in the technique making it simpler and technically perfect for wider adoption. The ever increasing use of blood transfusion in obstetric emergencies today is the only apology for this paper.

Here an attempt will be made to analyse our experience of about fourteen years with blood transfusion in the severely anaemic mothers. Our approach to transfusions in cases of severe anaemia in pregnancy is clearly demarcated in two epochs. The first between the years 1941 and 1944 was one of uncertainties. In the second phase between the years 1953 and 1956 we have felt more secure with transfusions. We have further attempted to work out the mode of utility of transfusions in this latter period.

From the review of a series of 270 cases during the earlier part of this work (Upadhyay 1944) it appears that megaloblastic erythropoiesis was present in 216 cases of anaemia (80 per cent). Treatment in these cases was obviously with liver extract (Israel 1941). We found the crude form of liver extract more useful and this formed the sheet anchor of our treatment. In a very small group (10 cases) blood transfusion was employed. To start with satisfactory transfusions were carried out in 6 cases. This was soon followed by on the spot casualties from severe transfusion reactions in quick succession in 4 cases. This had a demoralising influence particularly because blood transfusion in those years was a novel experience.

We thought for the moment from our experience, based on sternal marrow studies, that it would be easier to promote normal erythropoiesis by raising protein level in plasma and hence in the bone marrow by concentrated plasma transfusions which would immediately bring the plasma proteins to the threshold

where haematopoietic activity could be started and maintained by means of liver extract and iron. Our expectations on this line were fulfilled to an extent. It is worth mentioning that plasma substitutes were not marked till then.

After a lapse of about ten years blood transfusion was started by us with a fresh enthusiasm. Our results with plasma transfusion alone during the interim period were not striking since immediate oxygen carriage could not be maintained in very bad cases with red cells less than a million per cu. mm. It was difficult to tide over the period of crisis of nearly a week with oxygen inhalations alone on the insufficient number of cells till she reached the threshold level of plasma protein from where haemato-poiesis could get started. In surgical cases we noted at this stage that transfusion reactions were not so bad as noted in the earlier days. A change over the use of red cells was therefore obvious.

From the review of a series of 315 cases of this latter group the results were noted to be remarkably good with a resultant cure in 300 cases (95.2 per cent). It was interesting that even the onset of premature labour, noted earlier (Upadhyay, 1944) with resulting shock and death, in these grave cases was very much less (5 cases) than what we had expected. Megalocytosis in this series was present in 273 cases (86.6 per cent). The cure in such cases with transfusion confirmed our former belief that megalocytosis during the period of pregnancy is different from the pernicious anaemia type of megaloblastosis and is caused as a result of dietetic

protein deficiency (Upadhyay, 1944; Taylor and Chuttani, 1945; Wills and Mehta 1930). We have observed a relative megalocytosis even in normal pregnancy and we feel that this is due to a relative dilution in plasma protein concentration during pregnancy (Upadhyay, 1944).

Instead of whole blood we have recently used packed cells for transfusion in severe anaemias in pregnancy. In 30 cases done so far improvement occurred in 24 cases (80 per cent).

We have at this stage to decide the suitability among the three fluids, viz. concentrated plasma or its substitutes, whole blood and packed cells, in a case of severe anaemia in pregnancy. When administering plasma a relative dilution of red cells is produced in a fixed volume of blood but the blood proteins are elevated and they come to a particular level at which erythropoiesis is stimulated in the bone marrow. In our series we found that the bone marrow was non-reactive or very feebly reactive so long as the blood protein level was below 3.5 gm. per cent. We have felt that the so-called aplastic marrow is none other than the one exposed to prolonged hypoprotein-aemia. Reticulocyte response which is taken as the index of bone marrow activity does not appear till the protein level is brought to 3.5 gm. per cent in spite of all measures adopted to cure the anaemia. This supports the use of plasma transfusion in these anaemic patients. It is the need for immediate oxygenation which is lacking in the use of plasma substitution. Due to anaemic state the system is in great need of oxygen-carriers

which have to be furnished from outside. Blood transfusion subserved that function. Blood erythropoiesis is brought back to normalcy by virtue of plasma proteins coming back to the original state and oxygen carriage to tissues is done by the red cells present there.

It would be worthwhile considering the mode of action of the packed cells. One thing is certain that it provides for the immediate needs of oxygenation. It appears to us that the excess of red cells thrown into the general circulation, on breaking down, raise the globin fraction of the blood. It is by virtue of this phenomenon that plasma protein level is restored and erythropoiesis established. We have further noted (Upadhyay, 1944) that there is a relative diminution in blood volume in severely anaemic women. This we feel is a compensatory mechanism to supply oxygen needs to the vital centres through the very limited number of red cells. That this should be only a compensatory mechanism is further confirmed by our experience with the packed cell transfusion which has proved of immediate good in our cases. To our mind, therefore, the rational line of treatment is the use of packed cells in the very severely anaemic patients where there is a great lack of oxygen carriage, viz. where the red cell count is below 1 million per cu. mm. In a comparatively better case whole blood is the fluid of choice and once the emergency is passed off concentrated plasma should provide the best means of stimulating erythropoiesis. In the care of anaemic mothers our main stress is on regene-

ration of plasma protein machinery in the liver. We feel that this machinery does not work satisfactorily where plasma protein level is below 3.5 gm. per cent and the most important implication of its attenuated function is the influence that it exerts directly over haematopoiesis. If the plasma protein is below 3.5 gm. per cent haematopoiesis is always at a standstill no matter how much of iron or liver extract be forced to stimulate it. Therefore to maintain haematopoiesis at a distant date when further therapy is stopped one must necessarily raise the plasma protein regenerative mechanism to proper activity. For the immediate oxygen carriage to the vital centres red cells are certainly required but in case of severe anaemia in pregnancy as against the anaemia following acute haemorrhages a simple blood transfusion does not suffice since the need is one of maintaining her own erythropoiesis by keeping the plasma protein level at a minimum working requisite as well as to provide oxygen needs of the body. In other words one has to distinguish between the immediate oxygen needs due to anaemia and regeneration of red cells as a part of treatment of anaemia. The primary need is oxygen transport in severe forms and hence our recommendation for the packed cells. Diminished blood volume to our mind is only a compensatory mechanism and is undisturbed by the few and short transfusions that we give.

The next requirement is haematopoiesis, hence the need of raising plasma protein level or augmenting the plasma protein regenerative mechanism by supplying proteins in

the form of food or by parenteral route which means concentrated plasma, plasma substitutes, whole blood and crude liver extract. It is our belief that the beneficial effect of whole liver extracts as against the purified form in treatment of severe anaemia in pregnancy is by virtue of its influence on plasma protein regeneration mechanism in the liver which is augmented.

We have estimated the plasma protein in 162 non-pregnant and 121 pregnant women (Upadhyay, 1944). The mean result obtained in the former group is 7.21 gm. per cent. During pregnancy the result varied from 5.4 to 7 gm. per cent with an average mean of 6.3 gm. per cent. Statistically the mean deviation in the non-pregnant series is of the order of 0.735; in the pregnant series the deviation is 0.74. This is statistically significant and shows a definite drop in the protein concentration during pregnancy. Similar results have been obtained by Menon, Verghese and Satyanarayan while working on serum protein estimation in normal and abnormal pregnancy. According to them during normal pregnancies at term there is a statistically significant drop in the total proteins. This shows that the plasma proteins are intimately connected with these important physiological states, namely pregnancy, labour and puerperium. Such relations have also been observed in cases of toxæmias. It seems to us that the mechanism differs in toxæmias and anaemias inasmuch as erythropoiesis is concerned. The lowered plasma protein in eclampsia is probably not due to deficient diet. It is suggested that

due to an excessive excretion of aldosterone, a suprarenal corticoid, sodium and potassium ratio in the system is disturbed which leads to sodium retention and thereby oedema. Our experience with different types of transfusions during eclampsia is limited and work is still proceeding on these lines. Considering the above facts we are convinced that apart from the plasma protein level in the blood certain essential protein factors that are present in the normal human diet have an important bearing on the blood forming apparatus during pregnancy and its disorders.

Summary and Conclusions:

Effect of different types of fluids, viz. plasma, concentrated plasma, plasma substitutes, whole blood and packed cell transfusion in the treatment of anaemia in pregnancy has been analysed.

Two groups of cases have been studied. The first group of 270 cases was studied during the years 1941-1944 when our experience with transfusions was very meagre.

Another group of 315 cases has been studied in the years 1953-1956 when we felt more secure with transfusions and could record our views on their mode of action on erythropoiesis.

The role of plasma protein level in the blood in the maintenance of erythropoiesis as a treatment of severe anaemia has been stressed.

It has been pointed out that with a protein level below 3.5 gm. per cent the bone marrow is absolutely non-responsive to whatever treatment administered.

It has been suggested that the beneficial effect of crude liver extracts is due to their action on plasma protein regenerative mechanism in liver and not by way of furnishing haematoopoietic principle which is the common belief.

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