TREATMENT IN GENERAL PRACTICE

This article is one of a series on the management of some diseases of the blood and blood-forming organs met with in general practice.

TREATMENT OF NUTRITIONAL ANAEMIA OF INFANTS

BY

LEONARD G. PARSONS, M.D., F.R.C.P.

The anaemias of infancy and childhood, like those of adult life, may be divided into two great groups—the hypoplastic anhaemopoietic or deficiency group, and the haemolytic or erythronoclastic group. In its widest sense the term “nutritional anaemia” includes all the anaemias which fall into the first of these categories, but it is more frequently restricted to the hypochromic microcytic or milk anaemia of infancy. This, the most common and important of all the forms of anaemia in early life, is usually the result of a deficiency of iron in the diet, and possibly in some cases of an inadequate supply of copper and of substances containing the pyrrole ring.

Neo-natal Physiological Anaemia

To understand the rationale of the treatment of nutritional anaemia it is necessary to be familiar with the condition of the blood in the child at birth and during the early months of its life. In the foetus blood formation takes place widely throughout the reticulo-endothelial system, red cells being produced in the liver, spleen, and lymphatic tissues generally, and sometimes even in other organs, such as the kidney, in addition to the bone marrow. This extramedullary haemato-poiesis ceases at or shortly after birth, and throughout infancy and early childhood bone marrow is universally of the red type; nevertheless, embryonic depots may be recalled into activity should the necessity for rapid blood regeneration be sufficiently great, as in a severe anaemia. The infant *in utero* is living in a medium of low oxygen tension, and exactly as in adults who have to live at high altitudes it is necessary for the red blood cells to be present in increased numbers so that tissue respiration may be maintained. After birth, when the child breathes an atmosphere having a much higher oxygen tension, many of these cells become redundant, and are therefore destroyed, with the consequent formation of bilirubin and not infrequently the development of jaundice—the well-known icterus neonatorum.

Actually during the later weeks of intrauterine life there is a diminution in the number of red cells and the percentage of haemoglobin, but in spite of this the normal infant at birth may show a red cell count amounting to about 7,000,000 per c.mm., and a haemoglobin percentage of 120 or more. The fall in haemoglobin and red cells, although most rapid in the first week or two of life, is not limited to that time, but continues slowly for the first three or four months of life; further, the fall in haemoglobin is proportionate to that of the red cells, so the colour index remains normal. In this way there results a “physiological anaemia of the newborn.” This anaemia is probably due to the failure of the marrow adequately to adapt itself to the requirements of the rapidly growing child, and since this growth factor is of even greater importance in premature infants the fall in haemoglobin is greater in them, so that in the “anaemia of prematurity” the haemoglobin percentage is not infrequently as low as 60, or even 50.

Copper and Iron Deficiency

The physiological anaemia of the newborn does not require any treatment, and spontaneous recovery is usual about the fifth month of life; the anaemia of prematurity also recovers, but at a later date. Such recovery, however, occurs only if the substances already mentioned as necessary for haemoglobin synthesis are present in adequate amounts in the body stores, and/or are supplied in the food; otherwise a “nutritional anaemia” develops. Now both human and cow's milk contain only minute quantities of these essential substances, and cow's milk contains even less of them than breast milk, in spite of the fact that its iron and copper content is increased when it is stored in metal vessels or when it is dried on metal rollers.

The frequency of nutritional anaemia may vary in different districts, and the only reason why all infants do not become anaemic in the lactation period is that during the last three months of intrauterine life iron and copper are stored in the foetal liver. This store makes up for the lack of these metals in the infant's diet, but by the end of the lactation period it is exhausted; hence nutritional anaemia is certain to develop unless the child is then given a mixed diet containing adequate quantities of iron. If milk feeding is unusually prolonged a severe degree of this iron-deficiency anaemia occurs; also, not infrequently these iron and copper stores are exhausted, or become inadequate when the child is 6 or 7 months old, and anaemia becomes manifest. Further, if the mother does not receive sufficient iron during pregnancy, or if the infant is born prematurely or is one of twins, storage is inadequate; under such conditions anaemia develops even earlier in infancy, and in extreme cases may actually be present at birth.

Prevention of Nutritional Anaemia

Nutritional anaemia of infancy can therefore be prevented by assuring an adequate iron supply both to the mother during pregnancy and to the infant during the period of lactation, particularly if the child be artificially fed. So far as the mother is concerned the diet should contain 15 to 20 mg. of iron a day. It is probable that a large number of pregnant women do not obtain this amount of iron for two reasons: first, the restriction of the diet practised by many obstetricians as a preventive against the toxæmias of pregnancy; and, secondly, social conditions—for instance, the investigations of Davidson have shown that the diets of poor women in Aberdeen contain on an average not more than 11 mg. of iron a day. It is wise, therefore, to administer iron to any pregnant woman whose diet is restricted from medical or social reasons. For this purpose the following is a satisfactory prescription:

R.	Ferri et ammon. cit.	...	...	...	gr. xv
	Syr. aurant.	...	...	...	3 i
	Aq.	...	...	...	ad 3 i
				3 i, t.d.s.	

Alternatively one of the sugar-coated tablets of ferrous sulphate (gr. iij) prepared by the Glaxo Laboratories should be given three times a day.

Although it is stated that the application of iron sulphate to the soil will result in the growth of grass containing sufficient iron to ensure that milk from cows

fed on it will prevent nutritional anaemia, it is nevertheless still true that the artificially fed infant is best protected by feeding it on dried milk to which iron has been added, or by the daily administration of an adequate quantity of iron. "Haemolac," manufactured by Cow & Gate Ltd., is a good example of such a dried milk, the iron added being in the form of iron and ammonium citrate, and in amounts suggested by Helen Mackay, who found that, according to the age of the infant, $4\frac{1}{2}$ to 9 grains of this preparation were required daily to prevent anaemia. If this or a similar preparation of dried milk is not given the necessary intake can be assured by the daily administration of 1 grain of reduced iron, or 4 grains of ferrous sulphate, or 4 grains of iron and ammonium citrate.

Treatment with Iron

Treatment of established nutritional anaemia consists in the prescription of iron, which, in the absence of infection and in adequate doses, will bring about a cure in four or five weeks. Organic preparations of iron should not be used. One in which inorganic iron is present in the ferrous form, or can readily be converted into it in the infant's stomach, and which does not produce any alimentary upset, should be given. The preparations which have produced the best results are: ferrous sulphate, 12 grains; reduced iron, 3 grains; and iron and ammonium citrate, 12 grains—in each case divided into three doses and given daily. Of these ferrous sulphate is the most efficacious, although its iron content, while approximately the same as that of iron and ammonium citrate, is very much less than that of an equal amount of reduced iron. Actually one grain of reduced iron contains 54 mg. of iron, whereas one grain of ferrous sulphate contains only 12 mg.

The reason why ferrous sulphate is more active therapeutically is that all iron has to be converted in the stomach and duodenum into the ferrous form before it is absorbed. Witts has estimated that the percentage utilization of ferrous sulphate is 14, of reduced iron 0.5 to 2, and of iron and ammonium citrate, in which iron is present in the ferric state, 1.5 to 3. It is obvious, therefore, why 12 grains of ferrous sulphate are so much more efficacious than the same amount of iron and ammonium citrate, and also than 3 grains of reduced iron, although the latter is actually three times richer in metallic iron. The disadvantages of ferrous sulphate—namely, that it rapidly oxidizes to the ferric state and that children dislike it—can be overcome by dispensing it with syrup. The tablets referred to above are not suitable because of the difficulty in inducing infants to swallow them. Prescriptions for the administration of these forms of iron to be taken three times a day may be written thus:

R _x	Ferri sulphat.	...	...	...	gr. iv
	Aq.	...	...	...	q.s.
	Syr. simpl.	...	...	...	ad 3 ij
R _x	Ferri redact....	...	...	...	gr. i
	Sacch. alb.	...	...	...	gr. iij
				Ft. pulv.	
R _x	Ferri et ammon. cit.	...	...	...	gr. iv
	Syr. aurant.	...	...	...	3 ss
	Aq.	...	...	...	ad 3 ij

Copper and Yeast

In very rare cases it may be necessary to give copper before a complete cure is obtained. The dose should be 0.5 c.cm. of a solution of a 1 per cent. solution of copper sulphate per kilogram of body weight, and this is best administered in milk. Copper is not a constituent of the haemoglobin molecule, but probably acts as a catalyst, and enables stored or ingested iron to be used in the synthesis of haemoglobin. Happily the necessity for using copper hardly exists,

because all the iron preparations mentioned above contain sufficient copper as an impurity; indeed it is interesting to note that it is practically impossible to obtain iron without the presence of copper as an impurity.

Yeast also is sometimes valuable in treatment, and appears to act as a "potentiator" of iron in the synthesis of haemoglobin. The reasons why yeast acts in this manner are not clear, but in addition to iron it contains copper, vitamin B, and a body called cytochrome, which contains the pyrrole ring. It is best given in a dried form such as "yestamin," in doses of 1 to 3 drachms daily, although its administration is only necessary if the infant does not appear to be responding to iron. There are on the market several commercial preparations containing iron, copper, yeast, and sometimes manganese, and of these "ferrofax (powder)," made by British Colloids Ltd., has, in three daily doses of 50 grains, given excellent results in nutritional anaemia.

WOODHALL SPA REHABILITATED

VISIT OF HEALTH RESORTS ASSOCIATION

The village of Woodhall Spa in mid-Lincolnshire was invaded on Friday and Saturday last by sixty or more members of the medical profession and people interested in spa administration, on a visit arranged by the British Health Resorts Association. Sir Archibald and Lady Weigall and their daughter, Lady Curzon, acted as very gracious hosts. Lincolnshire is not regarded as a county that has great natural scenery, although it has many archaeological and architectural treasures, of which the visitors saw something on an extended tour embracing Tattershall and Bolingbroke Castles and the Tennyson country; but in Woodhall Spa, in its nest of pine and heath on the edge of the wolds, it has as pleasant a resort as is to be found in Great Britain.

The spa waters, which were discovered in the early part of the nineteenth century, when also the bathing establishment was built, are hypertonic saline, and contain appreciable quantities of iodine and bromine, as well as large amounts of calcium and somewhat smaller amounts of magnesium. They were well known to the older school of gynaecologists. The late Dr. McNaughton Jones, author of *Diseases of Women and Uterine Therapeutics* (1885), advocated treatment at Woodhall in certain cases of fibroids. For various reasons, chiefly connected with the rise of gynaecological surgery, the treatment has become less used than formerly. The waters have also proved effective in the treatment of rheumatic disorders and other affections, but the spa has passed through various economic vicissitudes, and is perhaps the least known of British health resorts, though the number of visitors is stated to be approximately 1,000 annually.

Recently the rehabilitation of the spa has been energetically undertaken, chiefly owing to the action of Sir Archibald Weigall and his family in transforming their beautiful home, Petwood, with its thirty-five acres of garden, into an ideal "individualistic" spa hotel, and also in equipping the Weigall Clinic, supplemental to the Victoria Baths, for patients for whom medical treatment has been prescribed. The baths, with the pump room, are of surprising extent and equipment, and the clinic provides all the usual baths and electrical treatments. A fango or mud is prepared from the powdered rock through which the waters percolate, and when mixed with concentrated water, or "mother-lye," is used in the form of hot compresses. In the surroundings of the spa there is considerable provision for sport and entertainment.

Spa Treatment in Gynaecological Cases

The historical use of the Woodhall waters in gynaecological conditions prompted the first of the two conferences which were held at Petwood during the doctors' visit and over which Mr. H. WILLOUGHBY SMITH presided. In opening the subject Dr. J. BRIGHT BANISTER said that spa treatment for gynaecological conditions had come to be regarded as old-fashioned, and some modern textbooks