EVALUATION OF IRON SUPPLEMENTATION IN PREGNANCY

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SUMMARY

This prospective longitudinal study was performed to evaluate the effect of new schedule of oral iron supplementation in pregnancy (Government of India) on various laboratory parameters indicating body iron status. A total of 112 women attending antenatal clinic were randomly selected. Haemoglobin level at the initial visit was the criterion to divide the women in two groups. Group I women whose haemoglobin was less than 11gm/dl were given 200mg and group II with haemoglobin above or equal to 11gm/dl received 100mg of elemental iron for a period of 100 days. Laboratory parameters done before and after iron supplementation indicated that both the groups showed significant improvement in both functional and storage compartments of iron after the supplementation. However, significant difference betweeen the two groups still existed suggesting the possible need for more iron therapy in anaemic patients.

INTRODUCTION

In developing countries, despite considerable improvement and awareness in the antenatal care, maternal iron deficiency anaemia still continues to remain a problem of great concern with regard to maternal morbidity, mortablity and adverse pregnancy outcome. Since iron requirement during pregnancy cannot be met by normal dietary intake, routine iron supplementation is recommended throughout the world. In India the National Nutritional Anaemia Prophylaxis Programme has been enforced for the last two decades, yet prevalence of anaemia in pregnancy remains alarmingly high. Thus recently Ministry of Health & Family Welfare recommended an in-

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crease in dose of iron supplementation. (Child Survival and Safe Motherhood Programme, Govt. of India 1991). Adequate iron supplementation is reflected by total body iron status rather than by an increase in erythropoiesis alone because in iron deficiency, storage iron depletion occurs first followed by iron deficient erythropoiesis. Thus it is necessary to evaluate the effectiveness of supplemented iron in terms of both correcting the anaemia and improving the iron stores. Accordingly the present study was planned to evaluate the effect of new dosage schedule of oral iron supplementation in pregnancy on various haematological parameters and parameters indicating total body iron stores.

SUBJECTS AND METHODS

The study was a prospective longitudinal one conducted in the department of Obstetrics & Gynaecology, University College of Medical Sciences and G T B Hospital, Delhi from August 1993 to July 1994. 112 women with singleton pregnancy between 16 to 20 weeks without any medical and obstetrical complications and without any prior iron intake were selected from the antenatal clinic. 10 ml of venous blood was collected, 6 ml of which was transferred into an iron free test tube, 2ml into EDTA vial and remaining 2ml in a plain vial from which serum was separated and stored at -20°C for the estimation of serum ferritin. Two good peripheral smears were made simultaneously. Complete haemogram was done and serum iron, TIBC & percentage transferrin saturation and serum ferritin were estimated. Depending on Hb concentration the patients were divided into two groups and supplemented with oral iron for 100 days as recommended by Ministry of Health and Family Welfare, Govt. of India. Thus group I included women with Hb< 11 gm% who were given 200mg of elemental iron and group II included those with Hb > 11 gm% who received 100 mg of elemental iron. Routine antenatal care was continued but the patients were motivated at each visit to ensure regular consumption of the iron tablets. After completion of 100 days of iron therapy the patients were again subjected to the same battery of investigations as in the beginning of therapy. The laboratory parameters before and after iron therapy were analysed by using paired t test.

RESULTS

Of the initial 112 women, 54% (61 women) were having haemoglobin less than 11 gm% and given 200mg of elemental iron. The remaining 51 patients whose haemoglobin was above or equal to 11 gm% were supplemented with 100mg of elemental iron. On follow up, however, 7 cases developed PIH and 9 had non compliance for various reasons and these 16 cases were therefore excluded from the study. Thus the data pertains to 96 cases, 50 in group I and 46 in group II. The clinical characteristics of these two groups as shown in table 1 were comparable in all respects.

Table 2 has detailed the laboratory parameters of group I (anaemic) women before and after iron therapy for 100 days. At booking there was not only iron deficient erythropoiesis but also the iron store was depleted as shown by low serum ferritin (< 12ng/ml). After therapy, there was a marked improvement in erythropoiesis

Table 1
Clinical profile of the patients in two groups at booking

	Group I	Group II
Number	50	46
Age in years (Range)	23.8 (17-35)	23.6 (19-33)
Parity (Range)	1.3 (0-4)	0.81 (0-2)
Weight in Kg (Range)	52.5 (45-62)	53.1 (43-65)
Period of gestation (in weeks)	18.2 (16-20)	18.1 (16.20)

Table 2
Pre and Post treatment haematological & iron status of group I

Parameter	Initial visit Mean (SD)	Final visit Mean (SD)	P value
Hb (g/dl)	9.66(0.96)	11.75(148)	<0.01
Hct (%)	29.96(3.65)	36.29(3.63)	<0.01
RBC ($x10^{12}$/L)	3.42(0.50)	4.14(0.48)	>0.05
MCV (fl)	88.54(10.38)	88.25(9.11)	>0.5
MCH (pg)	28.39(1.69)	28.58(3.62)	>0.5
MCHC (%)	32.32(1.69)	32.33(1.56)	>0.5
S. iron (mg/L)	0.84(0.68)	1.22(0.87)	<0.05
TIBC (mg/L)	4.60(0.78)	4.88(1.01)	>0.05
(%) Saturation	20.47(17.42)	25.96(16.85)	<0.05
S. Ferritin (ng/ml)	10.88(8.57)	24.52(19.70)	<0.01

indicated by a significant increase in haemoglobin and haematocrit. The mean haemoglobin was well above the WHO criterion of anaemia in pregnancy. However, RBC, MCV, MCH and MCHC did not show significant change. The iron status of these anaemic patients also improved significantly in all the parameters except TIBC. Serum ferritin which was well below normal at the beginning showed a signficant increase suggesting improvement in iron stores.

Similar findings were also noted in group II women (Table 3) who were not anaemic at the time of selection. But these women showed a much better iron store at the beginning of pregnancy in terms of serum ferritin values. Yet there was still improvement in both functional and iron stores after iron supplementation.

Table 3
Pre and post treatment haematological & iron status of group II

Parameter	Initial visit Mean (SD)	Final visit Mean (SD)	P value
Hb (g/dl)	11.76(0.59)	12.57(1.28)	<0.01
Hct (%)	35.67(1.99)	38.27(3.11)	<0.01
RBC ($x10^{12}$/L)	3.95(0.31)	4.18(0.35)	>0.05
MCV (fl)	90.85(4.65)	91.79(6.03)	>0.5
MCH (pg)	29.98(3.00)	30.09(2.31)	>0.5
MCHC (%)	33.01(1.07)	32.68(1.26)	>0.5
S. iron (mg/L)	1.07(0.43)	1.42(0.74)	<0.05
TIBC (mg/L)	4.48(0.59)	4.51(0.89)	>0.5
(%) Saturation	24.31(10.82)	33.30(18.28)	<0.05
S. Ferritin (ng/ml)	16.63(9.78)	36.93(31.23)	<0.01

Table 4
Haematologioal and iron status of the two groups on initial visit (pretreatment)

Parameter	Group I Mean	Group II Mean	P Value
Hb (g/dl)	9.66	11.76	<0.01
Hct (%)	29.96	35.67	<0.01
RBC ($x10^{12}$/L)	3.42	3.95	<0.01
MCV (fl)	88.54	90.85	>0.05
MCH (pg)	28.39	29.98	<0.05
MCHC (%)	32.32	33.01	<0.05
S. iron (mg/L)	0.84	1.07	>0.05
TIBC (mg/L)	4.60	4.48	>0.05
(%) Saturation	20.47	24.31	>0.05
S. Ferritin (ng/ml)	10.88	16.63	<0.01

The laboratory parameters of both the groups before and after the therapy were also compared (table 4) in order to find out the adequacy of iron dosage. Table 4 shows the pretreatment parameters depicting a significantly higher values in group II in all haematological parameters except MCV. The parameters such as serum

Table 5
Haematological and iron status of the two groups on final visit (Posttreatment)

Parameter	Group I Mean	Group II Mean	P Value
Hb (g/dl)	11.75	12.57	<0.01
Hct (%)	36.29	38.27	<0.01
RBC ($x10^{12}$/L)	4.14	4.18	>0.05
MCV (fl)	88.25	91.789	<0.05
MCH (pg)	28.58	30.09	<0.01
MCHC (%)	32.33	32.68	>0.05
S.iron (mg/L)	1.22	1.42	>0.05
TIBC (mg/L)	4.88	4.51	>0.05
(%) Saturation	25.96	33.30	>0.05
S. Ferritin (ng/ml)	24.52	36.93	<0.05

iron, TIBC percentage saturation were not statistically different. However, serum ferritin was significantly highr in group II. In table 5, a comparison of the laboratory parameters between the two groups after the completion of iron therapy showed that the significantly higher values in group II in the initial visit were still maintained in the final visit also. This finding suggests that the anaemic women probably still need more iron in terms of either duration or dosage and there is still scope for improvement.

DISCUSSION

This study showed a high prevalence of anaemia in pregnancy (54%) at the initial visit. These anaemic women were not only showing decreased erythropoiesis but were also having low serum ferritin (mean < 12ng/ml, table 2) indicating depleted iron store. Though the haemoglobin indices in pregnancy are primarily reflection of iron status and to a lesser extent of folate status (McGainty et al, 1987) yet these indices are of limited value in pregnancy. Serum iron is low because of high placental uptake of iron and TIBC increases even in iron replete women because of hormonal effect (Morgan, 1961). However, in this study only TIBC was not altered significantly even after iron therapy. Serum iron, transferrin saturation and serum ferritin values were significantly improved in both the groups after iron therapy. Serum ferritin reflects the body iron stores because of the permanent leakage of tissue iron into the blood stream (Buytaert et al 1983). During pregnancy because of various physiological changes, there is a difference at the cut off levels of serum ferritin to indicate iron store depletion. But a value of 12ng/ml is generally accepted and taken in our institute to indicate the minimum

iron store in pregnancy. In our study, the mean serum ferritin in group I at booking was well below 12ng/ml (table 2). This is in agreement with other studies that most women begin pregnancy in negative iron balance (Garby, 1973 and WHO 1972). But as expected, in group II women the serum ferritin values were significantly higher than values of group I patients indicating a better iron status at the beginning of pregnancy (table 2).

Microcytosis is a sensitive index for iron deficiency erythropoiesis in non pregnant state but in pregnancy its value is again limited by physiological increase in MCV (Chanarin et al 1977). In recent studies heterogenecity in red cell size was found to be more senstitive index than MCV (Osborne et al 1989). In the present study also, red cell indices such as MCV, MCH, MCHC were normal and not changed significantly after the iron therapy in both the groups. All the other haematological parameters indicating both functional and stores of iron were significantly improved following supplementation of iron for 100 days. Group I patients got their anaemia corrected with adequate iron store. There was significant improvement in iron status in Group II non anaemic women .also confirming the observation that even women who are conventionally grouped as non anaemic will have a scope of.further improving haemoglobin and iron status. This reinforces the concept of iron supplementation in pregnancy irrespective of initial haemoglobin value (Puolakka et al 1980 and WHO 1968).

The recommendation of iron for a period of 100 days by Government of India was shown to be sufficient in this study to correct the anaemia with improvement in iron store. But the persistence of difference between the iron status of group I and II patients even after the therapy for 100 days (table 5) suggests that the anaemic patients will probably still benefit from more iron supplementation in term of either duration or dosage.

REFERENCES

1. *Buytaert G., Wallenburg H.C.G., Van Eijck H.G., Butaert P., Europ J. : Obstet Gynec. Reprod Biol, 15; 11; 1983.*
2. *Chanarin I., McFadyen I.R., Kyle R.: Brit. J. Obstet. Gynec. 84; 504; 1977.*
3. *Child Survival and Safe Motherhood Programme India. Ministry of Health and Family Welfare, Govt. of India, New Delhi, July, 1991.*
4. *Garby L.: Cl Haemat, 2; 245; 1973.*
5. *McGainty W.J., Wawson E.B.: J. Reprod. Med. 32 (6): 475; 1987.*
6. *Morgan E.H.: Lancet 1; 9; 1961.*
7. *Osborne P.T., Burkett L.L., Ryan C.M.J., Lane M.: Am. J. Obstet Gynec. 160; 336; 1989.*
8. *Puolakka J., Janne O., Pakarinans A., et al: Acta Obstet Gynec. Scand Supple 95; 43; 1980.*
9. *WHO Tech. Rept. Ser. No. 503; 1972.*
10. *WHO Tech. Rept. Ser. No. 405; Geneva 1968.*