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Iron Status of Newborns Born to Iron Deficient Anemic Mothers

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Abstract: ***Serum iron, hemoglobin, total iron binding capacity and serum ferritin of babies born to 28 mothers of non-anemic iron deficiency, 16 mothers with iron deficiency anemia, and 9 mothers of normal serum ferritin and hemoglobin, were checked in the new born period and results did not show any significant difference in mean levels of serum iron, hemoglobin and total iron binding capacity inthese 3 groups but mean level of serum ferritin were lower in newborns of mothers with iron deficiency anemia.***

Keywords: serum ferritin, total iron binding capacity, new born, iron deficiency anaemia, maternal and foetal iron deficiency

1. Introduction

The most common complication in pregnancy is anemia.Theprevalenceofanemiainpregnantwomen is about 62.3% in India. Most of them are mild iron deficiency anemia and thus does not influence the fetus iron status. Iron is acquired by the fetus in uteroin constant proportion to normal increasingdemand, and that cord bloodhemoglobin level is similar in both non - anemic and anemic mothers.

About serum ferritin, several studies reported from developed countries have shown that maternal and newbornsferritin concentrations had little correlation[2].It is been reported that newborns' serum ferritin concentration appeared to be lower when the maternal ferritin concentration is less than 10 ng/ml.[3] These studies suggest that the fetal iron stores are reduced in iron depleted mothers compared to that in iron repleted mothers. Although the transfer of iron from the mothers to the fetus occurs against concentration, maternal iron is the only source of fetal iron during pregnancy. Therefore, it is logical to speculate that the maternal iron deficiency with or without anemia compromise the iron stores of newborns. The purpose of the study is to evaluate the iron stores in newborns born to mothers with iron deficiency anemia and non-anemic iron deficiency, as determined by cord blood serum ferritin.

Subjects

Fifty-three healthy mothers attending Sree Balaji Medical College and Hospital (age range 17—35 years, each had between one and three pregnancies) in labor and their full-term newborns with no prenatal or perinatal complications were recruited for the study. Those with birth weights > 2500 g, were selected as subjects. Fifty-three mothers were divided into two groups according to their predelivery hemoglobin and serum ferritin concentrations as follows:

1) IDA = iron deficiency anemia with hemoglobin concentrations < 11.0 g/d1 and serum ferritin concentrations < 7.1 ng/ml (mean-2SD of healthy adult women were considered as the cut-off value of iron depleted).
2) NIDA = non-anemic iron deficiency with hemoglobin concentrations > 11.0 g/dl and serum ferritin concentrations < 7.1 ng/ml.
3) NC = non-anemic and non-iron depleted mother with hemoglobin > 11.0 g/dl and serum ferritin concentrations >7.1 ng/ml were selected as normal control.

2. Materials and Methods

When the mothers were admitted for delivery, blood samples were obtained, and paired cord blood was also obtained at the time of labor for determination of serum iron, hemoglobin, total iron binding capacity, and serum ferritin. Maternal and paired cord blood hemoglobin values were determined by cyanmethemoglobin method. Serum iron was measured by nitroso-PSAP method. Serum total iron binding was determined by ion-exchange resin method using Amberlite CG-400 as adsorbent. Serum ferritin was determined by the duplicated enzyme immunoassay method. By analysis of variance the mean values of 3 groups are compared, and the rates of multipara or iron supplementation were compared by chi-square test. All statistical analysis was conducted after ferritin values log transformation since only log ferritin has a normal distribution.

3. Results

Table 1 shows mother's age was similar among the 3 groups. The rate of multipara or mother who had therapeutic iron supplementation during pregnancy did not differ significantly among the two groups.

Table 2 shows parameters of iron status in newborns of the 3 groups. Significant differences were not found in mean of serum iron, hemoglobin, and total iron binding capacity in the 3 groups, and lower mean values of serum ferritin were found in newborns of iron deficiency anemia mothers.

4. Discussion

Most mothers with anemia receive therapeutic iron supplementation during pregnancy. The mean maternal hemoglobin in IDA group of our study was 10.3 g/dl which indicated mild iron deficiency anemia. It has been thought that such mild anemia does not influence the hemoglobin and iron concentrations of the newborns as iron transfer from maternal to fetal compartment occurs against concentration gradient. For this reason, most clinicians have not been particularly concerned about the maternal iron status in the absence of significant iron deficiency anemia. The results of the present study also show that the levels of serum iron, hemoglobin and total ironbinding capacity were not differentsignificantly in newborns with mothers of different iron status.

Regarding serum ferritin, active iron transferresults in higher ferritin concentration in cord blood compared to that in maternal plasma. The ratio of cord blood plasma ferritin and maternal plasma ferritin concentrations (C/M ratio) seems a good index of unidirectional active process in maternofetal transport of iron. In iron replete mother who had prophylactic iron supplementation in pregnancy, C/M ratio was calculated as 5.0 (Table 3). In our study, particularly in IDA and NAID groups, C/M ratio was higher than that in iron-replete mothers suggestive of more active iron transport for compensation. On the other hand, it is presented that the level of cord blood plasma ferritin is low in moderate or severe anemic mother. Active iron transport appears not able to compensate deficient iron in moderate or severe anemic mother. About the iron stores of newborns, studies are done on serum ferritin levels. Rios et al.' reported that there was no significant difference in serum ferritin levels between infants of iron-depleted and non-iron depleted mothers. Kelly and Macdonald' also observed a significantly lower con- centration of ferritin in cord serum when the maternal ferritin value was less than 10 ng/ml than those associated with maternal serum ferritin greater than 30 ng/ml. Although there were no iron replete mothers in our subjects, the levels of serum ferritin were significantly different among newborns with different maternal iron status. Based on these findings and that of other investigators we can speculate that mild maternal iron deficiency and non-anemic iron deficiency will affect the iron stores of newborns.

All term infants are assumed to have sufficient iron in first 3 months as most of the total body iron is contained within the circulating hemoglobin. After 3 months of age iron stores are usually mobilized to meet the erythropoietic demands of expanding total hemoglobin mass because breastmilk is not sufficient in meeting the demands of growth. As a result, the level of plasma ferritin declines. Infants with small iron stores will deplete iron earlier than iron replete infants.

Table 1: Maternal Characteristics

Group	No	Mother's age	Multipara* n (%)	Iron supplementation* n (%)	Hemoglobin (g/dl)	Ferritin (ng/ml)
IDA	16	27±1.2	9(56.3)	5(31.3)	10.3±0.2	3.5(2.9-4.3)
NAID	28	29.4±0.9	19(67.9)	2(7.1)	11.8±0.1	3.5(3.2-3.8)
NC	9	26.4±1.4	4(44.4)	1(11.1)	12.3±0.4	12.2(9.5-15.6)
Significant Difference		NS	NS	NS	NS	NS

Values are expressed as arithmetic means+SE except for serum ferritin values which are expressed as geometric means+SE range.
*Values indicate number of multi para or mothers who received t the rapeuticiron supplementation during pregnancy. Valesin parentheses are percentages.

Table 2: Parameters of Iron Status of Newborns

Group	No	Birth weight(g)	Hemoglobin (mg/dl)	Iron (µg/dl)	TIBC (µg/dl)	FERRITIN
IDA	16	3183+124	16.2±0.4	85.9±11.3	234.9±18.6	77.1
NAID	28	3119+66	15.8±0.3	76.7±9.3	245±13.2	81.5
NC	9	2962+146	16.4±0.7	109±12.9	242±34.2	90.1
Significant Difference		NS	NS	NS	NS	<0.1

Values are expressed as arithmetic means+SE except for serum ferritin values which are expressed as geometric means+SE range

Table 3: Ratio of cord blood and maternal serum ferritin

Group	C/M ratio
IDA	29.2±2.1
NAID	30.7±3.8
NC	10.2±2.5
Iron repleted mother	5.0
Significant difference	P<0.05

Values are expressed as arithmetic means SE. *C/M ratio was calculated from the data of reference.

References

[1] Rios E, Lipschit z DA, Cook JD, Smith NJ. Relationship of maternal and infant iron stores as assessed by determination of plasma ferritin. Pediatrics 1975; 55: 694—9.
[2] Hussain MAM, Gaafar TH, Laulicht M, Hoffbrand A V. Relation of maternal and cord blood serum ferritin. Arch Dis Childh 1977; 52: 782—4.
[3] Kelly A, Macdonald DJ. Observations on maternal and fetal ferritin concentrations at term. Br J Obstet Gynaecol 1978; 85: 338-43.

[4] Watanabe N, K umai S, Takahashi S, Niilu Y, Situzaki I. Studies on the measurement of ferritin in serum wilh Ferritin 'M ITSU I' kit. H or mon to R insho 1983; 31: 595—9.
[5] Bhargava M, Lyer PU, Kumar R, Ramji S, Ka pani V, Bhargava SK. Relationship of maternal serum ferritin with foetal serum ferritin, birth weight and Gestation. J Trop Pediat 1991; 37: 149—52.