The Iron Status of Parturient Mothers and their New Born Babies

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Summary

Objectives: To evaluate the iron status of women in labour. To evaluate the iron status in the neonates of these subjects. To study the correlation between the iron status of these subjects and in their new born babies.

Design: Cross sectional cohort study

Setting: University Obstetric Unit, Galle

Patients and Methods: The serum ferritin(SF) and haemoglobin(Hb) levels were estimated in 74 pregnant women in stage II of labour, and in the cord venous blood obtained at delivery.

Results: Of the women 29(39%) had Hb<11g/dL and 22(30%) had SF<12ng/mL. The mean cord venous Hb of 13.8g/dL (SD 2.7) was significantly higher ($p<0.001$) than the mean maternal Hb of 11.1g/dL(SD 2.7). The mean cord SF of 85.8ng/mL (SD 41.9) too was significantly higher ($p<0.001$) than the mean maternal SF of 22.2ng/ml(SD 16.1). Although there was no correlation between the maternal and cord venous Hb, the cord venous SF was positively correlated to the maternal SF ($p<0.01$).

Conclusion: Iron status was unsatisfactory in this group of parturient women. A positive correlation was seen between the iron stores of the mother and the baby. However the baby's Hb correlated poorly with the mother's Hb level.

Introduction:

There are conflicting reports regarding the relationship of iron status in pregnant women to that of their new born babies. A strong positive correlation(1), a correlation when the maternal iron stores were low(2,3) and no correlation at all (4,5,6,7) have been reported. A positive correlation would further justify the need for adequate correction or iron status of pregnant women in countries like Sri Lanka where anaemia is highly prevalent.

Patients and Methods:

Women in stage II of labour with no previous antenatal or intrapartum complications and who delivered vaginally between 7AM and 2PM in the University obstetric unit in Galle on 3 five day periods commencing 18 January, 25 January and 1 February 1994 respectively were recruited for the study.

Informed written consent was obtained from all subjects and ethical approval for the study was obtained from the Faculty of Medicine, Galle.

Estimation of haemoglobin(Hb) was by cyanmethaemoglobin method and serum ferritin(SF) by the immunoradiometric assay using IRMA Ferritin Kits (Diagnostic Products Corporation, Los Angeles). Paired samples of 0.2mL venous blood were obtained separately from the selected subjects and from the placental end of the umbilical cord blood of their babies.

Maternal anaemia was defined as Hb<11g/dL, and maternal iron deficiency as SF<12ng/mL. A cord venous Hb>15g/dL was considered as normal.

The paired t test was used to compare the maternal and cord blood Hb and SF levels and the correlation between these was studied using Lotus and EpiInfo statistical packages. The chi

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square test was used to assess any relationship between maternal age, parity, period of gestation(POG) cord blood Hb and SF levels.

Results

There were 71(96%) subjects who were Sinhalese and the rest were Ceylon Moors and Malays. Their ages ranged from 17 to 42 years with a mean of 28 years. There were 40 primiparae, 30 multiparae and 4 grand multiparae. Education beyond the primary level had been achieved by 53(72%) of the subjects (Table 1) while the monthly family income exceeded Rs. 3000/- only in 24(32%) of subjects (Table 2). The majority were between 34-40 weeks of gestation (Table 3) and had received antenatal care for more than 8 weeks (Table 4). Of the 74 subjects 35(47%) had received antenatal care only from a Family Health Worker (Table 5).

There was no relationship between maternal age, parity, POG and socio-economic status of household and maternal and cord blood Hb and SF levels.

There were 29(39%) subjects who had Hb<11g/dL and 22(30%) who had SF<12ng/mL (Table 6, r=0.22, 95% Confidence Interval (CI)=-0.01 to 0.43; p>0.05).

There were 46(62%) babies with a cord venous Hb<15g/dL and 3 of them had a cord Hb<10g/dL. Eight(11%) of babies had a SF<20ng/mL while 3 of them had SF<12ng/mL. (Table 7, r=-0.10, 95%CI=-0.33 to 0.13; p<0.05).

The mean cord venous Hb of 13.8g/dL Standard Deviation (SD) 2.7 was much higher (p<0.001) than the mean maternal Hb of 11.1g/dL SD 2.7 (Table 8). There appeared to be a weak correlation between the two (Table 9, r=0.26, 95%CI=0.03 to 0.46; p>0.05).

The mean cord SF of 85.8ng/mL SD 41.9 was also much higher (p<0.001) than the mean maternal SF of 22.2ng/mL SD 16.1 (Table 10). There was a positive correlation between the maternal and cord venous SF levels (Table 11, r=0.31, 95%CI=0.09 to 0.51; p<0.01).

Table 1

Level of education (n=74)

School Grade	n	%
Grade 1 - 5	21	28
Grade 6 - 10	30	41
Grade 11 - 12	22	30
University Education	1	1
Total	74	100

Table 2

Monthly family income (n=74)

Rupees	n	%
0 < 500	3	4
500 - 1999	19	26
2000 - 2999	29	39
≥ 3000	24	32
Total	74	100

Table 3

Period of gestation (n=74)

Weeks	n	%
< 33	1	2
34 - 40	47	63
> 40	26	35
Total	74	100

Table 4

Duration of antenatal care (n=74)

Weeks	n	%
< 4	10	14
4 - 8	12	16
> 8	52	70
Total	74	100

Table 5

Source of antenatal care (n=74)

Source	n	%
Family Health Worker	35	47
General Practitioner	02	3
M.O.H. (Clinic)	22	30
Specialist	15	20
Total	74	100

Table 6

Relationship between Hb level and serum ferritin level in the mothers

SF ng/mL \ Hb g/dL	<8	8 - 10.9	11 - 12.9	≥13	Total
< 10	4	4	5	3	16
10 – 11.9	1	3	2	-	6
12 – 59.9	1	14	19	15	49
≥ 60	-	2	1	0	3
Total	6	23	27	18	74

(r=0.22, 95%CI=-0.01 to 0.43; p>0.05 - not significant)

Table 7

Relationship between Hb levels and serum ferritin levels in cord blood

SF ng/mL \ Hb g/dL	<10	10 - 12.4	12.5 - 14.9	≥15	All
< 12	-	-	2	1	3
12 – 19.9	-	1	1	3	5
20 – 59.9	-	6	2	5	13
≥ 60	3	16	15	19	53
All	3	23	20	28	74

(r=-0.10, 95%CI=-0.33 to 0.13; p>0.05 - not significant)

Table 8

Comparison of Hb levels in mother's and in cord blood (g/dL)

	Range	Mean	SD	SED	
Mother	4.4 – 17.6	11.1	2.7	0.4	p>0.05
Cord	6.6 – 18.1	13.8	2.7		

SED = Standard error of difference

Table 9

Relationship between maternal and cord Hb Level (g/dL)

Cord Hb \ Maternal Hb	<8	8 - 10.9	11 - 12.9	≥13	Total
< 10	-	2	1	-	3
10 – 12.4	4	10	4	5	23
12.5 – 14.9	1	3	13	3	20
≥ 15	1	8	9	10	28
Total	6	23	27	18	74

(r= 0.26, 95%CI=-0.03 to 0.46; p>0.05 - not significant)

Neither the cord venous Hb (r=-0.18, 95% CI=-0.40 to 0.05; p>0.05) nor the cord venous SF(r=0.01, 95%CI=-0.22 to 0.24; p>0.05) was correlated to the neonates' birth weight.

Discussion

Since labour is a dynamic process and the volume and the concentration of the various constituents of blood can vary from time to time, a single measurement of any constituent of blood may not be very reliable. Despite this, several studies which attempt to establish a relationship between the iron status of parturient women and their neonates have been published (1,2,3,4,5,6,7). In the present study too, reliance has been placed on samples of blood drawn at any one point of time.

Table 10

Comparison of serum ferritin levels in mother's and in cord blood (ng/mL)

	Range	Mean	SD	SED	Significance
Mother	4.0 – 85.0	22.2	16.1	7.0	p< 0.001
Cord	7.5 – 197.5	85.8	41.9		

SED = Standard error of difference

Table 11

Relationship between serum ferritin levels in mother's and in cord blood (ng/mL)

Maternal SF / Cord SF	<10	10 - 11.9	12 - 59.9	≥60	Total
< 12	2	-	1	-	3
12 – 19.9	3	1	1	-	5
20 – 59.9	4	4	5	-	13
≥ 60	5	3	41	4	53
Total	14	8	48	4	74

(r=-0.31, 95%CI=-0.09 to 0.51; p<0.01)

In this study, the degree of iron deficiency in pregnant women was found to be high at the time of delivery. A study done in Ohio, USA suggested that race has an effect on iron stores of parturients because black parturients had a lower Hb levels and higher SF levels than white parturients(7).

A lack of correlation between maternal and cord blood parameters of iron status has been seen in Hongkong(4), Singapore(5) and China(6). This lack of correlation is probably due to the foetus continuing to draw iron from the mother upto the time of delivery. Hence the mother's iron stores will continue to decrease till the cord is cut. In fact a negative correlation has been shown between the birth weight of the foetus and the maternal iron stores as well as period of gestation and maternal iron stores(4).

Criteria for the diagnosis of anaemia and iron deficiency in the neonate are not well established. In our study 46(62%) of babies had Hb<15g/dL while only 29(39%) of mothers were considered to be anaemic.

All the parturients in our study had received oral antenatal iron supplements, the majority for periods in excess of 8 weeks. This may have contributed to the increased serum ferritin levels in the newborns(8), as well as the satisfactory birth weights(3).

Babies born to anaemic mothers have been shown to have a higher risk of developing anaemia during infancy although they are not anaemic at birth(1,3). This is probably due to these babies having low iron stores in spite of good Hb levels. There were 3(4%) babies who had a cord venous SF<12ng/mL, and 8(11%) had a cord venous SF<20ng/mL. However, as normal levels of SF in the neonate are not well established, it is not possible to comment on these values.

Conclusion

In the group of parturient mothers studied, 39% were anaemic and 30% were iron deficient. While 62% of their neonates had Hb levels less than 15g/dL only 4% had SF levels less than 12ng/mL.

The iron stores of the baby appeared to be positively correlated to the iron stores of its mother while the baby's Hb was poorly correlated to the mother's Hb level.

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