

Cord Hemoglobin in Newborns in Correlation with Maternal Hemoglobin in Northeastern Iran

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Abstract

Background: Hemoglobin (Hb) and hematocrit (Hct) have been used routinely in the diagnosis of neonatal anemia and polycythemia.

Objective: To measure the cord blood Hb and Hct and to determine their association with maternal Hb and Hct.

Methods: 170 healthy neonates born through normal vaginal delivery with gestation age of 37-42 wks and birth weight of 2.5-4 kg, and their mothers were included in this cross-sectional study. Cord blood Hb and Hct of these infants and their mothers were measured by an electronic Coulter counter.

Results: We studied 97 male and 73 female neonates. The mean cord blood Hb was 15.8 (range: 11-21.4) g/dl, and Hct was 48% (range: 34%-63%). The mean±SD cord Hb of males (16.0±1.4 g/dl) was significantly ($p<0.05$) more than that of females (15.3±1.8 g/dl). Polycythemia (Hct>63%) was not found in any infants. However, 11.7% of newborns had an Hb<14 g/dl. Mean Hb of mothers was 12.3 g/dl. 18% of mothers had an Hb<11 g/dl. No significant correlation could be found between cord Hb and parity, birth weight and maternal age. No association could be found between cord blood and maternal Hb. Nevertheless, anemic neonates were born more frequently to mothers with low Hb.

Conclusion: We found that mean Hb in our newborns was less than previously reported values. Furthermore, we could find no correlation between cord and maternal Hb.

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Keywords • Hemoglobin • mother • newborn.

Introduction

The cord hemoglobin is an important index of hematologic status in newborns at birth. Hemoglobin (Hb) and hematocrit (Hct) values have been used frequently in the diagnosis and follow-up of neonatal polycythemia and various types of anemia. Other hematological parameters, e.g., white blood cell and platelet count have been proved helpful in the assessment of

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Parameter (Mean±SD)	Cord blood	Mother
Hb	15.8±1.7	12.3±1.6
MCV	111.5±8.1	89.7±8.0
MCH	34.8±2.3	30±2.7
MCHC	31.9±1.9	33±1.9

neonatal sepsis and hemostatic status of infant.¹ Several studies have reported a normal range of umbilical cord blood Hb values taken from healthy term infants²⁻⁴ Overall, average Hb concentration at term is 16.8 g/dl, with a range of 13.7-20.1 g/dl. In some studies, however, other values of mean cord Hb, out of this range, were reported^{1,5} Hematological norms have not still been established for newborns in Mashhad, northeastern of Iran. The aim of this study is to measure the cord blood Hb and Hct and to determine their association with maternal Hb and Hct.

Patients and Methods

This study was done at Ghaem Hospital during the first three months of 2000. All term infants born through normal vaginal delivery, with gestational age of >37 weeks and birth weight of >2.5 kg enrolled into the study. Newborns with pathologic jaundice, hemolytic anemia, and congenital malformation were excluded from the study. When the pregnancy or delivery was complicated with antepartum hemorrhage, eclampsia, or diabetes, the newborn was also excluded from the study. At the time of delivery, 1-ml of blood was obtained from the placental end of the umbilical cord after early ligation of the cord and after raising the baby to the level of the placenta. Hb and Hct were determined with an electronic H₁ Coulter counter. Meanwhile, a blood sample was taken from mothers. Maternal age, parity birth weight, and baby sex were also recorded. The data were analyzed with SPSS software.

Results

In this study, a total of 170 newborns (97 males, 73 females) met the inclusion criteria for the final

n (%)	Cord Hb (g/dl)		
	<14	>14	Total
Mother			
Hb(g/dl)	<11	9(5.4)	22(13.3)
	>11	11(6.6)	123(74.5)
Total		20(12)	145(87.8)
			165(100)

Re-searcher	Year	Mean Hb (g/dl)	Range	n
Mugrage & Andresen	1935	17.1	13-20	40
Guest	1938	17.9	13-22	34
Dochain	1952	17.9	14.5-21.6	40
Guest & Broun	1957	17.1	13-25	59
Rooth	1957	16.7	11.2-26.6	414
Burman	1974	16.2	-	140
Bassuni	1994	18.7	13-24	533

analysis. The mean±SD birth weight of infants was 3.07±0.38 (range: 2.5-4 kg). The mean±SD maternal age was 24.8±5.2 (range: 16-40) years. Most of mothers (35%) aged between 20 and 25. Parity one and two account for the 74% of deliveries. The mean cord blood Hb was 15.8 (range: 11-21.4) g/dl, and Hct was 48% (range: 34%-63%). The mean±SD cord Hb of males (16.0±1.4 g/dl) was significantly (p<0.05) more than that of females (15.3±1.8 g/dl). Polycythemia (Hct>63%) was not found in any infants. However, 11.7% of newborns had an Hb<14 g/dl. The mean±SD Hb of mothers was 12.3±1.6 (range: 7.8-16.9) g/dl. Eighteen percent of mothers had an Hb<11 g/dl (Table 1). No significant correlation could be found between cord Hb and parity, birth weight and maternal age. No association could be found between cord blood and maternal Hb. Nonetheless, more neonates with Hb<14 g/dl (29%) were born to mothers with Hb<11 g/dl relation to mothers with Hb>11 g/dl (8.2%) (Table 2).

Discussion

In this study we present an estimated normal ranges of Hb and Hct values for neonates born in Mashhad, northeastern of Iran. Many studies have reported different normal ranges for Hb values of umbilical cord blood of healthy term newborns (Table 3).^{3,4} These reports provide an overall average Hb concentration of 16.8 (range: 13.7-20.1) g/dl. Therefore, we considered Hb values <13.7 g/dl as anemia and those >20.1 as polycythemia. Blanchette and Zipursky came out to similar results; mean±SD cord Hb of 16.9±1.6 g/dl in full-term and 15.9±2.4 in premature infants.⁶ The mean Hb found in our study, however, was less than several reports from the United States and Saudi Arabia.^{1,7}

The mean cord blood Hb, Hct and MCV in another study done in Argentina was similar to those found in the present study.⁵ In another study conducted in Saudi Arabia, the mean Hb, and Hct from

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the cord blood of 533 normal term infants were 18.7 g/dl, and 57%, respectively.¹ In the latter study, no sex difference was reported regarding any of these two hematological parameters. Furthermore, no correlation could be found between maternal and umbilical cord Hb or Hct. On the other hand, we observed a significant difference between cord Hb in males and females ($p < 0.05$).

Though we could not show any statistically significant correlations between newborn weight, birth order, maternal age and Hb, newborns with weight > 3.5 kg had a higher Hb than those with weight < 3 kg.

In the current study, 20 newborns had Hb < 14 g/dl. Polycythemia in the newborns is defined as umbilical venous Hct $> 63\%$.⁸ Although, the prevalence of polycythemia in newborns is between 2% and 4%,⁸ none of our newborns had polycythemia.

Harthorn *et al*, have shown that iron deficiency in mothers during pregnancy does not influence the fetal iron supply.⁹ On the other hand, in another study done by Sweet in UK, it was shown that mothers with iron deficiency anemia during pregnancy (serum ferritin < 10 $\mu\text{g/l}$) gave birth to newborns with lower Hb levels. In our study, though not statistically significant, more neonates with cord Hb < 14 g/dl (29%) were born to mothers with Hb < 11 (8.2%).

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