

ROUTINE HEMATOLOGICAL VALUES IN TERM NEWBORNS

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ABSTRACT

Routine hematological parameters were investigated in 240 term normal neonates, 40 neonates in the first week of life and 49 infants between 3 and 6 months of age. Term normal neonates were selected on the basis of well defined criteria. Cord blood Hb values of 16.2 ± 1.5 g/dl compared well with some of the recent Indian studies and Caucasian figures. Cord blood hemoglobin was lower in the presence of low maternal hemoglobin and in newborns delivered by Cesarean section. A wide variation existed in the total and differential leucocyte counts, thus limiting the clinical utility of white cell counts in the newborn period. Platelet counts were within the adult normal range.

Key words: *Newborn, Hemoglobin, Platelets, Leucocytes.*

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The hematological parameters in newborns are distinctly different from normal adult values. A number of reports are available in our country(1-6). However, a variability in data exists. Earlier reports are based on ill-defined selection of newborns, variable site of blood samples and utilization of some obsolete methods. Some of the more recent studies have been performed on a limited number of newborns(2,3). We performed a study on 240 term normal neonates, the largest series reported so far from the country. Moreover, this is the first study from this region of the country and North of Delhi. It comprises a population base from Punjab, Himachal Pradesh, Haryana and parts of Uttar Pradesh and Rajasthan.

Material and Methods

The study was conducted on 240 term normal newborns, 40 neonates within the first 48-72 hours of life and 49 infants between the ages of 3 to 6 months. Term normal newborns were selected on the basis of a gestation of 37 weeks or more, uneventful antenatal period and absence of any congenital anomaly, respiratory distress, septicemia or metabolic disturbances. Those with evidence of blood group incompatibility were excluded. A total of 226 newborns had a normal vaginal delivery whilst 14 were delivered by elective Cesarean section because of cephalopelvic disproportions. Newborns included in the study were delivered either at the Nehru Hospital, PGIMER or the General Hospital, Chandigarh. Serial studies in the first 48-72 hours and beyond the age of 3

months could be performed only in 40 and 49 babies, respectively.

Cord blood was collected from newborns, while venous blood was drawn from older neonates into 1.5 mg/ml EDTA. The following investigations were performed: hemoglobin (oxyhemoglobin method), hematocrit, erythrocyte sedimentation rate, reticulocyte count, total and differential leucocyte count, blood smear examination and platelet count. The techniques utilized were as recommended by Dacie and Lewis(7).

Maternal hemoglobin values, parity and socio-economic status were noted at the time of delivery. The results were analysed using the Student's 't' test.

Results

The mean gestation period was 38.9 ± 1.2 weeks. The average birth weight was 2.92 ± 0.5 kg. The mean Apgar score at birth and 5 minutes was 8.0 ± 0.37 and 10.0 respectively. The birth weight of 228 (95%) was appropriate for gestation. Five newborns were small for date and 7 large for gestation.

The results of hematological values are summarized in *Table I*.

Cord Blood

The mean \pm SD hemoglobin (Hb) was 16.2 ± 1.5 g/dl with a range of 12.0-21.0 g/dl. The mean maternal Hb of newborns

TABLE I—Hematological Parameters in Cord Blood and Infancy

	Cord blood	48-72 hours	3-6 months
Hemoglobin (g/dl)	16.2 ± 1.5 (12 - 21.0)	16.2 ± 3.0 (8.3 - 20.2)	10.7 ± 1.4 (9.0 - 11.8)
Hematocrit (%)	49.4 ± 5.3	46.4 ± 8.2	27.9 ± 3.0
Erythrocyte sedimentation rate (mm/1st h)	1.3 ± 0.9 (0-8)	2.4 ± 3.2 (1-12)	—
Reticulocyte count (%)	3.1 ± 2.1 (0.4 - 12)	1.6 ± 1.2 (0.2 - 3.0)	0.2 ± 0.3 (0.05- 0.7)
Total leucocyte count ($\times 10^9/L$)	12.1 ± 6.4 (2.4 - 40)	8.6 ± 4.7 (3.6 - 17.2)	10.2 ± 3.7 (8.4 - 17.0)
Differential leucocyte count(%)			
Neutrophils	52.5 ± 16.0	46.5 ± 13.7	28.4 ± 9.5
Lymphocytes	41.6 ± 16.2	47.8 ± 14.4	66.5 ± 12.7
Monocytes	2.9 ± 2.3	2.2 ± 0.97	1.1
Eosinophils	2.27 ± 1.9	2.9 ± 1.8	4.0 ± 2.2
Nucleated red cells (per 100 WBC)	5.1 ± 3.6 (1-18)	0.09 ± 0.4 (0-2)	—
Platelet count ($\times 10^9/L$)	199.2 ± 56.55 (145-300)	189.0 ± 55.5 (140-290)	200.0 ± 64.5 (150-350)

with cord blood Hb less than 14.0 g/dl, was 9.6 ± 1.0 g/dl and was significantly lower than the maternal Hb values of 10.6 ± 0.9 g/dl in newborns with Hb in excess of 14 g/dl ($p < 0.01$). In babies delivered by Cesarean section, the mean cord blood Hb was lower (14.7 g/dl), despite maternal Hb being higher (12.2 ± 1.1 g/dl), than those newborns delivered normally. Parity did not influence maternal Hb or cord blood Hb values. Only 41.8% of cord blood values were in the range of 16 to 18 g/dl. Values less than 14 g/dl were observed in 12.0% neonates and more than 20 g/dl in 0.5%. A total of 29.8 and 15.7% values were in the range of 14-15.9 g/dl and 18.1-20 g/dl, respectively. The mean hematocrit was $49.4 \pm 5.3\%$. No direct correlation was observed with socio-economic status and cord blood Hb.

There was a mild leucocytosis, mean \pm SD being $12.1 \pm 6.4 \times 10^9/L$. A differential count revealed $52.5 \pm 16.1\%$ neutrophils, $41.6 \pm 16.2\%$ lymphocytes, $2.9 \pm 2.3\%$ monocytes and $2.2 \pm 1.9\%$ eosinophils. Metamyelocytes (2.0%) were observed in only one cord blood sample.

The ESR was low, 1.3 ± 0.9 mm/1st hour. A reticulocytosis of $3.1 \pm 2.1\%$ was observed. Red cells were macrocytic and normochromic. Circulating erythroblasts were observed in 21 of 240 neonates and ranged between 1-18 per 100 WBCs, mean value being $5.1 \pm 3.6\%$. Platelet counts were within the normal adult range.

First 48-72 hours of life

The mean Hb (venous blood) was 16.2 ± 3.0 g/dl with a hematocrit of $46.4 \pm 8.2\%$. The mean TLC was $8.6 \pm 4.7 \times 10^9/L$. On a differential count, there appeared to be a mild decrease in neutrophils (mean $46.3 \pm 14.4\%$) as compared to cord

blood. Monocytes and eosinophils constituted $2.2 \pm 0.9\%$ and $2.9 \pm 1.8\%$ of the differential count, respectively. The reticulocytes decreased to $1.6 \pm 1.2\%$. One neonate showed presence of circulating erythroblasts. Platelets were within the normal range. The red cells were macrocytic and normochromic.

Beyond third month of life (3 to 6 months)

The mean venous blood Hb was 10.7 ± 1.4 g/dl and hematocrit $27.9 \pm 3.0\%$. The mean TLC was $10.2 \pm 3.7 \times 10^9/L$ with a differential of $28.4 \pm 9.5\%$ neutrophils, $66.5 \pm 12.7\%$ lymphocytes, $4.0 \pm 2.2\%$ eosinophils and 1.1% monocytes. The reticulocyte count was $0.2 \pm 0.3\%$. Twenty-five of 49 infants showed presence of microcytosis and/or hypochromia in their peripheral blood smears. Platelets were normal in number.

Discussion

Hemoglobin and hematocrit values in cord blood of our term neonates compare well with those reported by Aneja *et al.* from Delhi(6) and Das and Banerjee from Calcutta(5). Rama Rao *et al.* from Karnataka(8) found lower cord blood Hb values (15.1 g/dl) while higher mean values (17.4 - 17.7 g/dl) were reported in four other series from different parts of the country(1,4-6). Differences in cord blood Hb levels might be due to varying numbers of newborns and different methodology. Time lapse between birth and clamping of cord also has considerable influence on cord blood Hb. Values in our study correlate with those of Caucasian newborns(9).

Hemoglobin and hematocrit levels in cord blood of African neonates have been discovered to be lower than Western figures as well as those in the present series, but role of ethnic differences is controver-

sial(10). In newborns with cord blood Hb less than 14 g/dl, maternal Hb was significantly lower. Thus, an anemic state in the mother has an adverse effect on neonatal Hb values. Also, babies delivered by Cesarean section had lower cord blood Hb values than those delivered normally. Perhaps the greater degree of fetomaternal hemorrhage during Cesarean section might account for this. Parity did not seem to affect the term cord blood Hb. Mean Hb values within the 48-72 hours were similar to cord blood values. Beyond 3 months of age the mean Hb was 10.7 g/dl, and almost 50% of the peripheral blood films revealed a mild to moderate hypochromia of red blood cells. Most of the infants with microcytosis and hypochromia were not on any iron supplements. Nucleated red blood cells were observed in only 8.7% of cord blood samples. Thus, erythroblastemia is an infrequent observation in normal cord blood. Reticulocytosis persisted in the first few days of life although it was of a milder degree than that of cord blood and was observed in 7.0% of neonates.

The mean cord blood TLC was $12.1 \times 10^9/L$ and ranged between $2.4 - 40.0 \times 10^9/L$. The proportion of neutrophils was 10 to 92%, with metamyelocytes and band forms in only one newborn. Thus, total and differential leucocyte counts are of limited clinical significance in newborns, although the presence of neutrophil precursors (metamyelocytes, band forms) might suggest the presence of intrauterine infections. Beyond 48 hours of age, most of the neonates had normal TLC and a differential count showing almost equal proportions of neutrophils and lymphocytes. In infants beyond the age of 3 months, the mean TLC was on the higher side of normal with relative lymphocytosis. An occasional infant had TLC exceeding $11 \times 10^9/L$

with 72% or more lymphocytes which may suggest the presence of a subclinical viral infection or an exaggerated response to immunizations.

Platelet counts remained within the adult normal ranges. Thus, newborn platelet counts below $150 \times 10^9/L$ and above $400 \times 10^9/L$ can be considered abnormal and require further investigation.

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NOTES AND NEWS

FOURTH PULMONOLOGY CONFERENCE OF THE RESPIRATORY CHAPTER OF I.A.P.

The 4th National Pulmonology Conference of the Respiratory Chapter of IAP will be held on *7th and 8th November, 1992* at Hotel West End, Bangalore. Faculty involves national/international speakers covering topics on air pollution, acute respiratory infection, newer techniques on diagnosis and management of various lung diseases, symposia on bronchial asthma, tuberculosis, workshop in inhalation therapy, pulmonary function tests, bronchoscopy, bronchial alveolar lavage and physiotherapy. Speakers will stress on physiological basis in management of these conditions in our country.

Registration fees:

Reception committee members	Rs. 400.00
Delegates	Rs. 300.00
Spot registration	Rs. 400.00
P.G. students/residents	Rs. 150.00

(P.G. students have to send their registration through their heads of Department with a covering note).

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