

INFLUENCE OF MATERNAL FACTORS ON HEMATOLOGICAL PARAMETERS OF HEALTHY NEWBORNS OF KARACHI

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Background: This study was conducted to observe the effects on cord blood CBC parameters of newborns of delivery routes (by spontaneous vaginal and caesarean section), maternal age and parity in our setup. **Methods:** This is a cross-sectional study based on cord blood sample of 404 newborns (271 delivered by spontaneous vaginally and 133 by elective caesarean section), and their mothers from July 2006 to April 2008. Three millilitre venous blood was collected in EDTA containing tube for complete blood count of mother before delivery of the baby. Immediately after the delivery of the baby, the umbilical cord was clamped and 5 ml cord blood was taken from the umbilical vein and transferred into an EDTA containing tube for CBC analysis. The data entry and analysis was done on computer package SPSS (Statistical Packages of Social Sciences) version 12.0. In all statistical analysis, only $p < 0.05$ was considered significant. **Results:** Haemoglobin, Red blood cell indices were found to be higher in vaginally delivered than caesarean section delivered babies ($p < 0.001$). Total leukocyte and neutrophils were also higher in vaginally born as compared to babies born by caesarean section ($p < 0.001$). Primiparous mothers have high haemoglobin, haematocrit and MCV whereas total leukocyte count and neutrophils were found to be lower in multiparous women. **Conclusion:** Mode of delivery and parity does have an influence on cord blood CBC parameters while maternal age has no effect.

Keywords: Haemoglobin, neutrophils, platelets, Vaginal, Caesarean section.

INTRODUCTION

Health of an individual is known to be different in different countries, in the same country at different times, and in same individuals at different ages. It is thus a relative and not an absolute stage. This means that the condition of individuals must be related to or compared with reference data. On comparing the individuals' data collected through the medical interview, clinical examination and supplementary investigations with the reference data, the condition of individuals can be interpreted.¹

Haemoglobin and haematocrit have been used routinely in the diagnosis of neonatal anaemia and polycythemia.² White blood cells and platelet count have proved helpful in the assessment of neonatal sepsis and haemostatic status of infant.³

It is now well established that newborn haematological parameters differ from infants and adults. A study was done which revealed that various blood indices vary in the newborns as compared to older child or adults.⁴ It depends on the gestational age, day of life, maternal factors, mode of delivery and site of blood collection.⁵ Furthermore, haematological values in newborns are an index of health and depend to large extent on maternal, social and geographical factors.⁴

A number of studies have been done to relate the maternal factors (differences in mode of delivery, maternal age, and parity etc.) with newborn haematological parameters. Studies have noted the difference in haematological values of neonates delivered by different methods. A study has shown that

the cord blood haemoglobin is lower in the newborn delivered by caesarean section.³ Another study has shown that the number of total leukocytes, neutrophils, band forms and platelets are significantly higher in vaginally born newborns than the neonates born by caesarean section.⁶

We do not have data on correlation of maternal factors with newborns haematological parameters in our setup and as we are living in developing world, so we need to explore these findings. The objective of this study is to correlate the maternal factors (mode of delivery: vaginal verses caesarean section), maternal age and maternal parity (abortion not included) with haematological parameters of newborns using cord blood.

MATERIAL AND METHODS

This is a cross sectional study design based on cord blood sample of newborns and their mothers from four hospitals in Karachi. The study was conducted at Sindh Government Qatar Hospital, Ziauddin University hospital, goal market campus, Sindh Government hospital, Liaquatabad and Chinniot Maternity and Child Hospital, Karachi.

Four hundred and four (404) newborns (271 delivered by spontaneous vaginally and 133 by elective caesarean section), recruited from above mentioned hospitals from women age between 15 to 45 years came in labour room or for caesarean section from July 2006 to April 2008.

Detailed history was taken from mothers regarding their age, parity, gravida, socioeconomic history etc. and physical examination was also done.

Inclusion Criteria

Mother

- Pregnant woman. (booked cases)
- Uneventful pregnancy.
- Haemoglobin ≥ 10 g/dl

Neonates

- Full term (37 to 42 weeks) with normal birth weight (2.5–4.0 Kg)

Exclusion Criteria for mother were Multiple pregnancy, Diseases complicating pregnancy (anaemia, antepartum haemorrhage, pregnancy induced hypertension, eclampsia, diabetes (gestational or insulin dependent), heart, kidney or lung disease, malaria, disseminated intravascular coagulation), Thalassaemia/Sickle cell disease, Drug or alcohol abuse, Immediate shock like state after post partum period and emergency caesarean section

Exclusion criteria for the neonate were Abnormal partogram, Perinatal blood loss, Hydrops fetalis, Birth asphyxia, Low APGAR score < 8 at 5 minutes, Obvious congenital/chromosomal abnormality and Pathologic jaundice (within 24 hours of birth).

Procedure of cord blood sampling was explained to the mother. Written informed consent was also taken from mothers.

Three ml venous blood was collected in EDTA containing tube for complete blood count of mother when she came in labour or for elective caesarean section. After delivery of the baby, the umbilical cord was clamped immediately. Then 5 ml cord blood was taken from umbilical vein and transferred into an EDTA containing tube. The sample was then sent as early as possible (maximum 3 to 6 hours) to Ziauddin hospital laboratory for analysis. For haematological parameters a standard coultergram was done on the Beckman Coulter Counter Max M. The differential leukocyte count was counted by light microscopy using Leishman’s stained smears. Recording of nucleated RBCs was done as per 100 leukocytes using Leishman’s stained smear and expressed the WBC count as corrected for the presence of nucleated RBCs if its number was 10 or more.

The data entry and analysis was done on computer package SPSS (Statistical Packages of Social Sciences) version 12.0. To compare means and standard deviation of haematological values, between normal vaginal delivery and caesarean section, maternal age, and parity student’s *t*-test was used. In all statistical analysis, only $p < 0.05$ were considered significant.

RESULTS

A total of 404 (206 males and 198 females) neonates with a mean birth weight of 3.03 ± 0.38 Kg were studied.

Table-1 shows the comparison between SVD and elective caesarean section group in terms of CBC parameters of newborns. The result shows that Haemoglobin, Red Blood Cell count, Haematocrit, Mean corpuscular volume were found to higher in vaginally born infants than Caesarean section ($p < 0.001$), whereas Mean corpuscular Haemoglobin Concentration was more higher in Caesarean section group babies ($p < 0.001$). Total leukocyte count and neutrophils were found to be higher in vaginally group than caesarean section ($p < 0.001$). Platelets and Nucleated Red Blood Cells showed no significant differences in these two groups.

Table-1: Comparison of haematological values of newborns delivered by Spontaneous Vaginal Delivery and Elective Caesarean Section

Parameters	SVD (n=271)	C/Section (n=133)	p-value
Haemoglobin (gm/dl)	15.16 \pm 1.51	14.64 \pm 1.33	<0.001*
Red Cell Count ($10^{12}/L$)	4.35 \pm 0.46	4.16 \pm 0.39	<0.001*
Haematocrit (%)	46.61 \pm 4.87	43.71 \pm 4.12	<0.001*
MCV (fl)	106.45 \pm 6.78	104.51 \pm 4.69	<0.001*
MCH (Pg)	34.84 \pm 2.25	35.21 \pm 1.79	0.07
MCHC (gm/dl)	32.20 \pm 1.631	33 \pm 2.8	<0.001*
TLC ($10^9/L$)	14.67 \pm 4.14	11.46 \pm 3.55	<0.001*
Neutrophils (%)	53.08 \pm 10.61	44.12 \pm 13.72	<0.001*
Lymphocytes (%)	37.03 \pm 10.49	45.71 \pm 13.45	<0.001*
Monocytes (%)	6.59 \pm 2.9	6.49 \pm 2.8	0.738
Eosinophils (%)	3.22 \pm 1.97	3.48 \pm 2.51	0.317
Basophils (%)	1.14 \pm 0.83	1.13 \pm 0.354	0.971
NRBCs (per 100 WBCs)	8.24 \pm 15.28	6.15 \pm 7.91	0.210
Platelet Count ($10^9/L$)	259.67 \pm 83.63	249 \pm 59.82	0.165

*significant

To find relation between maternal age and neonatal haematological values using cord blood, we divided the women into 2 groups. Group A, consisted of women between 15 to 27 years of age (n=273) and group B of women between 28 to 45 years (n=131). We compared the 2 groups with haematological parameters of newborn babies. Table-2 shows the results.

Table-2: Effects of maternal age on haematological values of newborns using cord blood

Parameters	Group A (n=273)	Group B (n=131)	p-value
Haemoglobin (gm/dl)	14.96 \pm 1.51	15.06 \pm 1.40	0.54
Red Cell Count ($10^{12}/L$)	4.27 \pm 0.44	4.32 \pm 0.46	0.32
Hematocrit (%)	45.59 \pm 4.85	45.79 \pm 4.79	0.70
MCV (fl)	105.98 \pm 6.35	105.47 \pm 6.01	0.43
MCH (Pg)	34.99 \pm 2.06	34.90 \pm 2.22	0.68
MCHC (gm/dl)	32.41 \pm 2.35	32.59 \pm 1.52	0.42
TLC ($10^9/L$)	13.88 \pm 4.23	13.05 \pm 4.18	0.06
Neutrophils (%)	51.08 \pm 11.99	48.15 \pm 13.15	0.027*
Lymphocytes (%)	38.99 \pm 11.81	41.76 \pm 12.93	0.03*
Monocytes (%)	6.65 \pm 2.91	6.37 \pm 2.78	0.35
Eosinophils (%)	3.23 \pm 2.08	3.47 \pm 2.32	0.30
Basophils (%)	1.05 \pm 0.49	1.33 \pm 1.11	0.48
NRBCs (per 100 WBCs)	6.19 \pm 6.68	10.24 \pm 20.87	0.07
Platelet Count ($10^9/L$)	259.48 \pm 77.75	249.57 \pm 73.82	0.22

*significant

There were no differences in two groups in terms of haemoglobin, haematocrit, RBCs count, MCV, MCH, MCHC and total leukocyte count. We found that neutrophils were high in group A ($p<0.032$), whereas lymphocytes were high in group B ($p<0.04$). The values of both the groups were statistically significant.

To find relation between maternal parity with neonatal haematological parameters we divided the maternal parity into Primiparous ($n=229$) and multiparous ($n=175$) and compare these two groups with newborn haematological parameters. Haematocrit was high in primiparous ($p<0.027$). MCV was also found to be high in primiparous ($p<0.001$). Total leukocyte count was low in multipara as compared to primiparous ($p<0.004$). Monocytes were high in primipara ($p<0.034$). Eosinophils were high in multipara group ($p<0.005$). Other parameters of CBC showed no significance (Table-3).

Table-3: Influence of parity on haematological parameters of newborns using cord blood

Parameters	Primiparous (n=229)	Multiparous (n=175)	p-value
Haemoglobin (gm/dl)	15.10±1.46	14.85±1.48	0.08
Red Cell Count ($10^{12}/L$)	4.30±0.44	4.28±0.45	0.72
Haematocrit (%)	46.12±4.80	45.05±4.81	0.02*
MCV (fl)	106.72±5.95	104.62±6.41	0.001*
MCH (Pg)	35.12±1.88	34.76±2.37	0.10
MCHC (gm/dl)	32.32±2.49	32.65±1.48	0.12
TLC ($10^9/L$)	14.14±4.19	12.92±4.18	0.004*
Neutrophils (%)	51.03±11.72	48.95±13.27	0.09
Lymphocytes (%)	39.09±11.50	40.93±13.09	0.14
Monocytes (%)	6.82±3.02	6.21±2.62	0.03*
Eosinophils (%)	3.02±1.85	3.67±2.47	0.005*
Basophils (%)	1.13±0.50	1.14±0.94	0.94
NRBCs (per 100 WBCs)	6.78±7.46	8.42±17.95	0.34
Platelet Count ($10^9/L$)	253.20±75.02	260.19±78.49	0.36

*significant

DISCUSSION

The study was conducted to find out the effects of mode of delivery (vaginal verses caesarean), maternal age and parity on haematological parameters of newborns using cord blood. A number of differences in CBC were found between vaginal and elective caesarean section groups of newborns.

Increased levels of haemoglobin, RBCs count, haematocrit and MCV were observed in vaginally born infants as compared to infants born by elective caesarean section probably due to the high degree of foeto-maternal haemorrhage during caesarean section.³

Total WBCs count and neutrophils were high in vaginally born babies than elective caesarean section. This is most likely due to the physical stress and periodic hypoxia, which is more frequent and prolonged with vaginal delivery as compared to delivery by caesarean section.⁷ During stress the hormone

epinephrine and hydrocortisone may play a role in high counts of total WBCs in vaginally born infants.⁷

The result of our study was similar to the study done by (Sheffer-Mimouni G, *et al*, 2003) and (Marwaha N, *et al*, 1992), but contradictory to the study done by (Nikischin W, *et al*, 1997), which showed no differences in erythrocyte count. This could be because of more controlled haemorrhage during caesarean section in the later study. However the study did find that the mean leukocyte count after spontaneous birth and after vacuumed extraction were significantly higher than after caesarean section.⁷

Another study has found that the cord blood from vaginal delivery had a significant higher WBCs concentration compared with cord blood from caesarean section.⁸

A study was done which found that platelet count was high in vaginally born infants.⁹ It was also higher in our study but the difference was not statistically significant.

We also found that maternal age has no influence on complete blood count parameters of newborns, which is similar to the study done by various authors. However there was one exception in that neutrophil count was higher in early age group mothers probably because of high degree of stress during labour than late age mothers or this might be a non specific finding due to the large sample size.

It has been estimated that about 350 mg of iron is needed by the foetus to form its blood and an additional 600 mg is required by the mother to form her own extra blood. Therefore, the women in lower socioeconomic group, teenagers and multiparous are at high risk of iron deficiency.¹⁰ In our study primiparous mothers had high haemoglobin, haematocrit and MCV, a result that is similar to a number of other studies. This probably reflects the poor nutritional status in multipara and less iron stores during intrauterine phase.

Total leukocyte count and neutrophils were also lower in multiparous women than primipara, probably which reflects the lesser amount of stress during labour in multiparous women as they have gone through the process many a times before.

CONCLUSION

It can thus be concluded that mode of delivery and parity does have an influence on cord blood CBC parameters while maternal age has no effect.

We recommend that similar type of studies be conducted in rural areas of Sindh as well as other provinces of Pakistan to fully comprehend the effect on CBC parameters of newborns of various other factors effecting delivery as diet, environment and methods used during delivery by traditional Dai's especially in the rural population.

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