Evaluating the effect of maternal factors on total and differential leucocyte count of healthy newborns in cord blood

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ABSTRACT

Background: To evaluate the effect of maternal factors (parity, age and type of delivery) on total and differential leucocyte count of healthy newborns in cord blood.

Methods: The study was conducted on 200 healthy newborns admitted in neonatology section of Department of Paediatrics, Govt. Medical College/Rajindra Hospital, Patiala. Cord blood sample (2ml) was taken at birth by milking the cord into an EDTA containing vial. TLC was done by manual method (haemocytometer method) using improved Neubauer Chamber. DLC was done by Smear made from the EDTA blood stained by Leishman stain (Romanowsky group) in body and tail part of the stained smears by following Z pattern.

Results: Mean TLC and DLC was done in cord blood of healthy newborns and it was compared with parity (P1, P1-P3,>P3), age of mother (<25 yrs, 25-30,>30yrs) and type of delivery (NVD/LSCS and mode of presentation).

Conclusions: It was seen that maternal factors (parity, age and type of delivery) didn’t have effect on Mean TLC of newborns, whereas statistical difference for DLC in relation to maternal parity was significant for neutrophils and Monocytes and highly significant for Monocytes related to mode of presentation. However, statistical difference for Mean DLC in babies was not significant in relation to age of mother and type of delivery.

Keywords: TLC, DLC, NVD, LSCS, Parity

INTRODUCTION

Despite the fact that the infant is dependent on the mother for its nourishment, the striking diversity in the haematological picture of the two has led to a number of studies on cord blood and subsequent changes in the blood picture in the neonatal period. Various authors had studied value of TLC and DLC in new-borns. 

It has been studied by some that haematological parameters depends on the gestational age, day of life, maternal factors, mode of delivery and site of blood collection. Furthermore, haematological values in newborns are an index of health and depend to large extent on maternal, social and geographical factors. Studies have been done to relate the maternal factors (differences in mode of delivery, maternal age, and parity etc.) with new-born haematological parameters. Some studies even have noted the difference in haematological values of neonates delivered by different methods. One author studied total and differential leukocyte counts during the first 5 days of life in relation to the method of delivery. An another study has shown that the number of total leukocytes, neutrophils, band cells and platelets are significantly higher in vaginally born newborns than the neonates born by caesarean section.

Till now studies have been done to find any relation of maternal parity and delivery factors with total and differential count in healthy new-borns. Thus objective of this study is to determine effect of maternal factors (parity, age and type of delivery) on total and differential leucocyte count values in healthy new-borns using umbilical cord blood.
METHODS

The study was conducted on 200 healthy new-borns admitted in neonatology section of Department of Paediatrics, Govt. Medical College/Rajindra Hospital, Patiala. Maternal and Neonatal data was recorded. Babies born to mother with Pregnancy induced hypertension (PIH), Gestational diabetes, Fever, Prolonged labour, Premature rupture of membranes, Foul smelling liquor, Dilation and handling. Multiple vaginal examinations, Instrumentation during delivery were excluded from the study. Similarly, the babies with septicaemia, birth asphyxia, respiratory distress syndrome, blood group incompatibility, intraventricular hemorrhage, congenital malformation of heart, malformed babies, small for gestational age and large for gestational age were also excluded. Cord blood sample (2ml) was taken at birth by milking the cord into an EDTA containing vial and was used for determining total and differential leucocyte counts. TLC was done by manual method (haemocytometer method) using improved Neubauer Chamber. Using a WBC pipette, blood was filled up to 0.5mark. Neubauer's chamber will be charged with WBC pipette. Using low power objective (20x), WBCs were counted in the four larger corner squares. The numbers of WBC’s per cumm were calculated as follow:

\[
WBC = \frac{\text{Cells counted} \times \text{Dilution factor} \times \text{Depth factor}}{2 \times \text{Area of chambers counted}}
\]

Where, dilution factor = 20, depth factor = 10, area of chambers = 4.

**Table 1:** TLC and DLC in relation to parity.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Cases</th>
<th>TLC Mean ± SD (Reference range)</th>
<th>Mean ± SD (Reference range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>&lt;P&lt;sub&gt;1&lt;/sub&gt;</td>
<td>93</td>
<td>9275±1397 (4500-12800)</td>
<td>5115±1426 (2520-9600)</td>
</tr>
<tr>
<td>P&lt;sub&gt;1&lt;/sub&gt; – P&lt;sub&gt;3&lt;/sub&gt;</td>
<td>102</td>
<td>9012±1590 (4500-13400)</td>
<td>4529±1419 (1032-9360)</td>
</tr>
<tr>
<td>&gt;P&lt;sub&gt;3&lt;/sub&gt;</td>
<td>5</td>
<td>9372±994 (8400-11000)</td>
<td>4941±974 (4032-6600)</td>
</tr>
<tr>
<td>Statistical Analysis</td>
<td></td>
<td>F = 0.816</td>
<td>F = 4.189</td>
</tr>
</tbody>
</table>

Mean TLC in new-borns with age of mother <25 yrs was 9191±1439/cumm, in with 25-30 yrs was 9101±1483/cumm and in with >30 yrs was 9130±1907/cumm. Statistical difference in mean TLC in different groups was not significant. Mean DLC in three groups was; Neutrophils (cumm) were 4970±1435 in babies with age of mother <25 yrs, 4753±1493 with age of mother 25-30 yrs and 4237±866 with age of mother >30 yrs; Lymphocytes (cumm) were 4055±952 in babies with age of mother <25 yrs, 4183±1108 with age of mother 25-30 yrs and 4955±1159 with age of mother >30 yrs ; Monocytes (cumm) were 99±158 in babies with age of mother <25 yrs, 84±146 with age of mother 25-30 yrs and 112±153 with age of mother >30 yrs.

**RESULTS**

Total and differential leucocyte count was done in cord blood of 200 healthy new-borns and relation with maternal delivery factors and parity was evaluated. Results were interpreted and it was found that mean TLC in babies born to mothers with parity less than 1 was 9275±1397/cumm, with parity 1 to 3 was 9012±1590/cumm and with parity more than 3 was 9372±994/cumm. Statistical difference between mean TLC in babies born to mothers with different parities was not significant, whereas Mean DLC in three groups was; Neutrophils (cumm) were 5115±1426 in babies of mothers with parity <1, 4529±1419 in p1-p3 and 4941±974 in p3; Lymphocytes (cumm) were 4051±1001 in babies of mothers with parity <1, 4243±1110 in p1-p3 and 4357±308 in p3; Monocytes (cumm) were 68±119 in babies of mothers with parity <1, 120±175 in p1-p3 and 19±42 in p3; Eosinophils (cumm) were 45±85 in babies of mothers with parity <1, 69±108 in p1-p3 and 36±50 in p3; Basophils (cumm) were 18±53 in babies of mothers with parity <1, 24±57 in p1-p3 and 17±39 in p3; Immature cells (cumm) were 1±12 in babies of mothers with parity <1, 2±15 in p1-p3 and 0 in p3; Statistical difference for DLC in three groups was significant for neutrophils and Monocytes (Table 1).
age of mother >30 yrs; Immature cells (cumm) were 0.94±8 in babies with age of mother <25 yrs, 2±16 with age of mother 25-30 yrs and 6±25 with age of mother >30 yrs; Statistical difference for DLC in three groups was not significant (Table 2).

### Table 2: TLC and DLC in relation to age of mother (years).

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Cases</th>
<th>TLC Mean ± SD (Reference range)</th>
<th>Mean ± SD (Reference range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(Reference range)</td>
<td>N</td>
</tr>
<tr>
<td>&lt;25 years</td>
<td>90</td>
<td>9191±1439 (4500-12200)</td>
<td>4970±1435 (2600-9600)</td>
</tr>
<tr>
<td>25-30 years</td>
<td>95</td>
<td>9101±1483 (4500-13100)</td>
<td>4753±1493 (1032-9360)</td>
</tr>
<tr>
<td>&gt;30 years</td>
<td>15</td>
<td>9130±1907 (6000-13400)</td>
<td>4237±866 (2730-5880)</td>
</tr>
<tr>
<td>Statistical analysis ANOVA</td>
<td></td>
<td></td>
<td>F = 0.085</td>
</tr>
</tbody>
</table>

### Table 3: TLC and DLC in relation to type of delivery.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Cases</th>
<th>TLC Mean ± SD (Reference range)</th>
<th>Mean ± SD (Reference range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(Reference range)</td>
<td>N</td>
</tr>
<tr>
<td>NVD</td>
<td>130</td>
<td>9194±1531 (4500-13100)</td>
<td>4926±1511 (1643-9600)</td>
</tr>
<tr>
<td>LSCS</td>
<td>70</td>
<td>9049±1419 (6400-13400)</td>
<td>4601±1272 (1032-7992)</td>
</tr>
<tr>
<td>Statistical analysis ANOVA</td>
<td></td>
<td></td>
<td>t = 0.653</td>
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### Table 4: TLC and DLC in relation to type of presentation.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Cases</th>
<th>TLC Mean ± SD (Reference range)</th>
<th>Mean ± SD (Reference range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(Reference range)</td>
<td>N</td>
</tr>
<tr>
<td>Vertex</td>
<td>183</td>
<td>9174±1476 (4500-13400)</td>
<td>4858±1454 (1032-9600)</td>
</tr>
<tr>
<td>Breech</td>
<td>16</td>
<td>8616±1488 (6000-10900)</td>
<td>4858±1454 (2730-6479)</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>12000±0 (12000)</td>
<td>6240</td>
</tr>
<tr>
<td>Statistical Analysis ANOVA</td>
<td></td>
<td></td>
<td>F = 2.929</td>
</tr>
</tbody>
</table>

Mean TLC in new-borns delivered by NVD was 9194±1531/cumm and in those delivered by LSCS was 9049 ±1419/cumm. Statistical difference in mean TLC in two groups was not significant. Mean DLC in two groups was; Neutrophils (cumm) were 4926±1511 in babies born by NVD and 4601±1272 in babies born by LSCS; Lymphocytes (cumm) were 4116±993 in babies born by NVD and 4231±1149 in babies born by LSCS; Monocytes (cumm) were 87±139 in babies born by NVD and 104±173 in babies born by LSCS; Eosinophils (cumm) were 53±96 in babies born by NVD and 65±100 in babies born by LSCS; Basophils (cumm) were 16±41.
in babies born by NVD and 31±73 in babies born by LSCS; Immature cells (cummm) were 2±13 in babies born by NVD and 2±15 in babies born by LSCS. Statistical difference for DLC in two groups was not significant (Table 3).

Mean TLC in new-borns delivered by vertex presentation was 9174±1476/cumm, in delivered by breech presentation was 8616±1488/cumm and in delivered by other presentations was 12000/cumm. Statistical difference in mean TLC in different groups was not significant. Mean DLC in three groups was; Neutrophils (cummm) were 4858±1454 in babies born with vertex presentation, 4858±1454 in babies born with vertex presentation, and 4560 in babies born with other presentation; Lymphocytes (cummm) were 4152±1060 in babies born with vertex presentation, 4183±976 in babies born with breech presentation and 4560 in babies born with other presentation; Monocytes (cummm) were 90±1±40 in babies born with vertex presentation, 74±120 in babies born with breech presentation and 960 in babies born with other presentation; Eosinophils (cummm) were 54±93 in babies born with vertex presentation, 80±132 in babies born with breech presentation and 240 in babies born with other presentation; Basophils (cummm) were 21±55 in babies born with vertex presentation, 18±40 in babies born with breech presentation and 120 in babies born with other presentation; Immature cells (cummm) were 2±13 in babies born with vertex presentation, 5±20 in babies born with breech presentation and 0 in babies born with other presentation; Statistical difference for DLC in two groups was highly significant for Monocytes (Table 4).

**DISCUSSION**

The present study included 200 healthy new-borns admitted to neonatology section of department of paediatrics Govt. medical college /Rajindra Hospital Patiala. Cord blood sample was collected and TLC, DLC were measured at birth.

In present study mean TLC in babies born to mothers with parity less than 1, parity 1 to 3 and parity more than 3 was 9275±1397, 9012±1590 and 9372±994/cumm respectively. Statistical difference in mean TLC between babies born to mothers with different parities was not significant whereas Statistical difference for DLC in three groups was significant for neutrophils and Monocytes. Neutrophils (cummm) were 5115±1426 in babies of mothers with parity <1, 4529±1419 in p1-p3 and 4941±974 in p>3 and Monocytes (cummm) were 68±119 in babies of mothers with parity <1, 120±175 in p1-p3 and 19±42 in p>3. A similar study showed low TLC in babies born to multiparous than primiparous. It also witnessed monocytes were high in primipara and eosinophils were high in multipara group.15 Our study showed comparable result regarding monocytes but instead of eosinophils neutrophils showed statistically significant value high in primi compared to multipara. Similarly another study showed low TLC and other hematological values except lymphocyte count with increasing parity.14

In present study it was found that maternal age has no relation with mean TLC and DLC of new-born. Similar results were shown by others except one study that showed high neutrophils in young mothers and high lymphocytes in old age mothers.15

The value of mean TLC in new-borns delivered by NVD and LSCS was studied by various authors.15,16 Nikischin W et al studied that the mean TLC after spontaneous birth (14600±4000/cumm) were significantly higher than after cesarean section (12100±4400/cumm; p <0.05). Sparrow et al studied that the mean TLC in new-borns delivered by NVD had a significantly higher TLC concentration compared with that from cesarean section (medians: 17100 and 13600/cumm, respectively; p <0.0001). However, in our study mean TLC and DLC in new-borns delivered by NVD and LSCS was studied and statistical difference between two groups was not significant.

In our study mean TLC in new-borns delivered by vertex presentation, breech presentation and by other presentations was 9174±1476, 8616±1488 and 12000/cumm respectively. Statistical difference in mean TLC between three groups was not significant. Statistical difference for DLC in two groups was highly significant for Monocytes. Monocytes (cummm) were 90±140 in babies born with vertex presentation, 74±120 in babies born with breech presentation and 960 in babies born with other presentation; EOSINOPHILS (cummm) were 54±93 in babies born with vertex presentation, 80±132 in babies born with breech presentation and 240 in babies born with other presentation; Statistical difference for DLC in two groups was highly significant for Monocytes (Table 4).

**CONCLUSION**

Effect of maternal factors (parity, age and type of delivery) on Mean TLC of newborns was statistically not significant. Statistical difference for DLC in relation to maternal parity was significant for neutrophils and Monocytes while highly significant for Monocytes related to mode of presentation. However, statistical difference for Mean DLC in babies was not significant in relation to age of mother and type of delivery.

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**Conflict of interest:** None declared  
**Ethical approval:** The study was approved by the Institutional Ethics Committee

**REFERENCES**
