

Nucleated RBC Count as Predictor of Neurological Outcome in Perinatal Asphyxia

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The immediate and short term outcomes of term newborns with perinatal asphyxia were studied in relation to the nucleated red blood cell count at admission. The mean (SD) NRBC/100WBC (white blood cells) was significantly higher in sequelae group than normal [9.8 (98.9) vs. 2.9 (43); $P = 0.001$].

Keywords: Birth asphyxia, Neurologic disability, Outcome.

There is a need for a reliable marker to predict the course of hospital stay and short term prognosis in term newborns with perinatal asphyxia. Chronic or acute hypoxia is one of the most important causes of increased nucleated RBC count (NRBC count) in a neonate [1]. We studied the role of NRBC count in prediction of neurological outcome in perinatal asphyxia. Term newborns with perinatal asphyxia (Apgar Score <7 at 1 min) were enrolled within 6 hours of birth. The study was approved by the Institutional Ethical Committee.

Absolute NRBC count and NRBC count per 100 white blood cells (WBC) were done at admission using a venous sample. The smear was stained using Leishman stain. The NRBCs and leucocytes were counted manually till 500 white blood cells (WBCs) and then reported as NRBC/100 WBCs. All the counts were done by a 3rd year post graduate student of pathology and cross checked by the consultant. The consultant who finally reported remained same for all the samples. Neonates with convulsions were managed as per standard protocols. The immediate outcome was categorized into: neurologically normal (those who had normal tone and posture, were free from seizures, had good cry and activity and normal neonatal reflexes) and neurologically abnormal (those with an abnormal tone and posture or poor cry and activity or any abnormal neonatal reflexes at discharge or death). Children were followed up till 6 months for any sequelae such as hypertonia, epilepsy, spasticity and delayed milestones.

A total of 177 neonates were enrolled but 12 of the discharged neonates did not report for follow-up at six months; final analysis of 165 was done. Out of these, 97 were born vaginally and 68 were born by lower segment

caesarean section (LSCS). Fifteen neonates died during hospital stay. At discharge, 127 neonates were neurologically normal and 23 neonates were neurologically abnormal. At six months follow-up, 68.7% neonates were neurologically normal and 31.3%

TABLE I NUCLEATED RBC COUNTS RELATED TO BIRTH ASPHYXIA

| <i>Characteristics</i> | <i>NRBC/100WBC mean (SD)</i> | <i>P value</i> |
|--|------------------------------|----------------|
| Hypoxemic Ischaemic Encephalopathy | | |
| Stage II | 4.4 (4.5) | 0.005 |
| Stage III | 8.1 (5.2) | |
| Need for 2 nd loading with phenobarbitone | | |
| Yes | 7.2 (4.8) | 0.048 |
| No | 4.6 (5.2) | |
| Need for 2 nd anticonvulsant | | |
| Yes | 7.1 (4.8) | 0.387 |
| No | 5.4 (5.1) | |
| Age at first convulsion | | |
| <12h | 7.7 (5.6) | 0.007 |
| ≥12 h | 4.3 (4.2) | |
| Age at start of feeds | | |
| <48h | 5.1 (7.1) | 0.987 |
| ≥48h | 5.1 (6.7) | |
| Outcome | | |
| Discharged | 5.0 (6.7) | 0.322 |
| Expired | 7.0 (5.2) | |
| Neurological status at discharge | | |
| Normal | 4.4 (6.6) | 0.007 |
| Abnormal | 7.9 (6.0) | |
| Neurological status at 6 mo | | |
| Sequelae present | 9.8 (8.9) | 0.001 |
| No sequelae | 2.9 (4.3) | |

developed sequelae. The NRBC/100WBC was significantly higher in sequelae group than normal ($P < 0.001$) (**Table I**). By drawing receiver operating characteristics (ROC) curves, NRBC $> 450/\text{mm}^3$ and NRBC/100WBC > 3.25 prediction had a sensitivity of 90% and specificity of 74.3% for predicting development of neurological sequelae at 6 months of age. Many studies have estimated the NRBC count in the cord blood [2-5].

The NRBC count and NRBC/100WBCs were significantly higher in newborns who had a convulsion within 12 h of birth, those who developed hypoxic ischemic encephalopathy (HIE) stage III, those who required a second loading with phenobarbitone, and those requiring a second anticonvulsant. In our study, NRBC count at birth was significantly higher among newborns with sequelae and those who expired, which was also observed in other studies [6-8]. The limitations of the study are short duration of follow-up and absence of other parameters like magnetic resonance imaging, cord blood pH and electro-encephalography.

We conclude that nucleated RBC count can be used as an early marker of severity of birth asphyxia during hospital stay, and may be useful to predict the neurological outcome in asphyxiated neonates.

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