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RESEARCH ARTICLE

PERINATAL OUTCOME IN BABIES WITH HIGH CORD BLOOD NUCLEATED RED BLOOD CELL COUNT.

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ABSTRACT

Background: Perinatal asphyxia is a serious problem and is a common cause of neonatal mortality and morbidity. Various predictors have been used to predict perinatal asphyxia but correlation between the clinical and biochemical markers have been poor. NRBC count has been found associated with adverse fetal outcome. **Aim of study:** To assess NRBC count and its relation with perinatal outcome. **Methods:** This prospective case control study was conducted in Lalla-Ded hospital GMC Srinagar from Mar 2019-Mar 2020. We studied 200 patients beyond 38 weeks of pregnancy into two groups with 100 patients each in case and control group. After delivery Cord blood sample was assessed for pH, base excess and nucleated RBC count. Perinatal outcome was compared. **Results:** The mean NRBC count of cases was 23.3 ± 10.1 and it was 12.5 ± 4.7 in control group. The difference was statistically significant. Also NRBC count correlated with non-reassuring fetal heart rate pattern, meconium stained liquor, low 1min 1nd 5 min Apgar. NICU admission was significantly high in babies with high NRBC count with significant mortality and morbidity. **Conclusion:** NRBC count can be used as a marker to confirm perinatal asphyxia. The test is simple, quick, accurate and effective to diagnose and start treatment to prevent long term sequelae.

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INTRODUCTION

Perinatal asphyxia is a condition of impaired blood gas exchange that, if persists, leads to progressive hypoxemia and hypercapnia with a metabolic acidosis. Essential characteristics defined jointly by American academy of pediatrics and the American college of obstetrics and Gynecologists should be present.

- Profound metabolic or mixed acidosis on umbilical cord arterial blood sample
- Persistence of an Apgar score of 0-3 for more than 5 min
- Neurological manifestations in immediate neonatal period which include seizure, hypotonia, coma or hypoxic-ischemic encephalopathy.

Reflex activated by asphyxia consists of shunting of blood from skin and splanchnic areas to the heart, adrenals, and brain to protect them from hypoxic injury (John, 2007). perinatal asphyxia remains a significant cause of perinatal morbidity and mortality the world over, and is known to complicate 5-10% of all deliveries (Low, 1997).

Various parameters to define perinatal asphyxia are Apgar score, umbilical arterial acidemia, intrapartum electronic fetal monitoring, scalp PH measurement and presence of meconium in amniotic fluid. However no single marker has shown of perinatal asphyxia has shown good predictive efficacy and a combination of various indices can help in early diagnosis of perinatal asphyxia.³ Considering the hematopoietic response to hypoxia in utero, the elevated count of nucleated red blood cells was investigated as marker of hypoxia.⁴Recent publications have shown a significant association between nucleated red blood cell count and adverse perinatal outcome such as low Apgar scores and pH values, fetal growth restriction, perinatal brain damage, and early onset seizures.⁵⁻⁸ Erythropoietin stimulated due to hypoxia, is increased in cord blood, in itself, is a marker of fetal hypoxia.⁹ Acute increase in nucleated red blood cell counts may be secondary to mobilization of endogenous cytokines such as IL-6 which is markedly increased in response to hypoxia.¹⁰

Aims and objectives: To study the cord blood nucleated RBC count in asphyxiated and non-asphyxiated fetuses at birth. To find out the fetal outcome in babies with high NRBC count.

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MATERIALS AND METHODS

This prospective comparative study was conducted in the department of Obstetrics and Gynecology GMC Srinagar. Inclusion criteria were Primigravida, singleton pregnancy, 37-40 weeks, Rh +ve cases. 100 cases were taken in study group and 100 in control group. For the cases two or more of the following criteria were chosen. Thick meconium stained amniotic fluid. Non reassuring fetal heart rate pattern. Apgar score ≤ 6 at 5 minute of birth. A detailed record of obstetric, menstrual, past, medical or surgical history was taken. A detailed examination was done. From all the subjects, immediately after delivery, a 10-15 cm segment of cord was isolated between two clamps. Umbilical arterial blood was drawn from cord into heparinized syringe for estimation of pH. A second sample was taken in an EDTA coated bottle for making peripheral blood smear for nucleated RBC count against WBCs until 100 WBCs were counted. The correlation between NRBC count and low Apgar score was also analyzed. Neonatal admission to NICU, hypoxic ischaemic encephalopathy, morbidity and mortality was assessed. Infants were followed to 8 weeks of age. Data was expressed as mean and percentage. The characteristics of cases and controls were compared by student t test, Mannwhitney U-test, chi-square analysis and analysis of variance.

Observations

Table 1: Maternal characteristics

	Cases	Controls	P value
Mean age \pm SD	27.5 \pm 4.2	26.9 \pm 4.6	0.406
Mean gestational age	38.4 \pm 1.2	38.4 \pm 1.1	0.839
Haemoglobin(grams)	10 \pm 1.7	9.8 \pm 1.7	0.390

Table 2. Distribution as per route of delivery

Mode of delivery	Cases (%)	Controls (%)	P value
Vaginal	52	65	0.063(NS)
LsCS	48	35	

Table 3: Distribution of risk factors in studied population

		Cases	Controls	P value
Meconium	+++	51	0	0.000
	++	43	0	
	clear	6	100	
Fetal heart rate pattern	Reassuring	23	100	0.000
	Non Reassuring	77	0	
Apgar score at 5 min	>6	25	100	0.000
	≤ 6	75	0	
Number of risk factors	0	0	100	0.000
	2	54	0	
	3	46	0	

Table 4. Distribution of birth weight and gender

	cases	controls	P value
Birth weight	2.93 \pm 0.48	3.04 \pm 0.49	0.119
Gender of babies			
Males	48	53	0.481
Females	52	47	

Table 5. Correlation between umbilical artery pH, base excess, and cord blood nucleated RBC count/100 WBCs in cases and controls

	cases	controls	P value
Umbilical artery pH	6.945 \pm 0.088	7.227 \pm 0.578	<0.0001
Base excess	-13.7 \pm 4.1	-3.7 \pm 3.7	<0.001
NRBC count	23.3 \pm 10.1	12.5 \pm 4.7	<0.001

As obvious from above table 5, a significant correlation was seen between NRBC count, low umbilical artery pH and base excess

Table 6. Correlation between NRBC count/100 WBCs and 1 minute Apgar score in study population

Apgar score at 1 min	N=200	min	max	Mean \pm SD	P value
≤ 6	94	5	40	23.5 \pm 10.1	<0.001
>6	106	6	31	12.9 \pm 5.4	

Table 6 shows Nucleated RBC count was significantly increased in babies with low Apgar (23.5 \pm 10.1) and babies with good Apgar (12.9 \pm 5.4)(p<0.001)

Table 7. Correlation between NRBC count/100 WBCs and 5 minute Apgar score in study population

Apgar score	number	min	max	Mean \pm SD	P value
≤ 6	75	7	40	24.0	0.000
>6	125	5	40	14.2	

Table 8. Incidence of NICU admission in cases and controls

NICU admission	Cases(100)	Controls(100)	P value
Yes	45	2	0.000
No	55	98	

Nicu admission was significantly high in cases as compared to controls. Nucleated RBC count was higher in babies with NICU admission (p<0.001).

Table 9. Cord blood NRBC count/100WBCs in relation with NICU admission

NICU admission	n	Min	Max	Mean \pm SD	P value
Yes	45	8	40	29.5	<0.001
No	55	6	31	18.3	

Table 10: Neonatal outcome in asphyxiated group

		n	%
Neonatal outcome	Surviving	95	95.0
	Died	5	5.0
HIE	Yes	21	21.0
	No	79	79.0
HIE grade	Mild	10	47.6
	Moderate	7	33.3
	Severe	4	19.0

Table 11. Nucleated RBC count/100 WBCs in various grades of HIE

HIE grade	n	min	max	Mean \pm SD	P value
Mild	10	10	39	26.2 \pm 10.3	0.107(NS)
Moderate	7	26	38	33.0 \pm 4.4	
Severe	4	26	40	35.8 \pm 6.6	

5% of asphyxiated babies died and in surviving 21% developed hypoxic ischaemic encephalopathy and in those 19% had severe grade of HIE. There was a non-significant difference between various grades of HIE.

DISCUSSION

Various studies have suggested that elevated umbilical cord NRBC counts are associated with either acute and chronic fetal hypoxia. Present study was done to evaluate the same. In our study max number of patients was in the age group of 25-34yrs with a mean of 27.5 ± 4.2 . Similar age group patients were studied by B. Ghosh et al. (?). The mean gestational age was 38.4 ± 1.2 and 38.4 ± 1.1 respectively. Dasari Papa et al¹² studied mean gestational age of 38.95 ± 0.69 and 39.25 ± 1.06 respectively. In our study 52% of cases and 65% of controls delivered vaginally whereas 48% cases and 35% controls delivered by LSCS. While assessing markers of asphyxia, it was observed 94% of cases had meconium, 77% had non-reassuring fetal heart rate pattern and 75% of cases had Apgar score < -6 at 5 min of birth. The respective proportion of cases in the study by Dasari Papa et al were 79%, 90% and 90%. In our study mean umbilical arterial pH in cases was 6.945 ± 0.088 whereas in controls it was 7.22 ± 0.578 . While assessing the relationship of between cord blood nucleated Red blood cells and umbilical artery pH, it was observed that the mean NRBC count /100WBC in asphyxiated group was 23.3 ± 10.1 and non asphyxiated group it was 12.5 ± 4.7 . In a study by B Ghosh et al¹¹ the mean cord blood NRBC count/100 WBC in asphyxiated group was 16.5 ± 6.4 and in non asphyxiated it was 8.6 ± 7.01 .

In a study by ROYA Faraji et al¹³ the mean NRBC/100 WBC in subjects having meconium stained liquor was 8.6 ± 6.54 compared to 3.88 ± 3.92 in controls having clear liquor. Apgar score was devised as a quickly evaluating the status of the neonate. In our study the mean NRBC count/100wbcs was 23.5 ± 1 in neonates with Apgar score < -6 at 1 min and 12.9 ± 5.4 in neonates having Apgar score > 6 at 1 min. In the study by B Ghosh et al (Low, 1989) the correlation coefficient between NRBC count/100WBCs and Apgar score at 1 min was -0.50 . In the study by Dasari Papa et al⁴⁷ the mean NRBC count was 36.23 ± 10.01 in neonates with Apgar score at 5 min < -6 and 13.04 ± 6.42 in neonates with Apgar score at 5 min > 6 ($p=0.026$). While assessing the relation between cord blood NRBC/100WBC and non-reassuring fetal heart pattern, our study established a statistically significant correlation, the mean counts were higher in non-reassuring fetal heart rate pattern than those in reassuring FHR pattern (23.6 ± 10.4 vs 14.4 ± 7) ($p < 0.001$). Neonates cared for in the neonatal intensive care unit had a higher nucleated RBC count than did those who recovered either with their mothers or in the regular neonatal nursery. The incidence of NICU admission in our study was 45% in cases and 2% in controls. The mean NRBC count in neonates admitted in NICU was 29.5 ± 9.3 whereas in the rest of the cases it was 18.3 ± 7.6 ($p=0.001$). In the study by Dasari Papa et al⁴⁷ the incidence of NICU admission was 57.69% in cases and the mean NRBC count was much higher in these neonates as compared to those who were cared in regular nursery ($p < 0.005$). Cord blood NRBC count correlated well with fetal acidosis. As umbilical artery pH and base excess decrease, nucleated red blood cell counts increase. Elevated NRBC counts are also associated with lower Apgar scores, meconium and admission to the special care nursery. 5% of babies with hypoxia died and 21% developed HIE, Among

babies with HIE 10,7,4 had mild, moderate, severe grades of HIE respectively.

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