

# *The Effect of Prelabour Rupture of Membranes on Circulating Neonatal Nucleated Red Blood Cells*

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## **Abstract**

**Background:** Prelabour rupture of membranes is a problem that faces the obstetricians. It has many maternal and fetal sequale and its etiology and management still controversial.

**Objective:** To test the absolute nucleated red blood cells counts at birth in infants who are born after prelabour rupture of membranes.

**Methods:** A prospective study conducted in AL-Kadhymia Teaching Hospital. Hundred pregnant women were included in this study. Fifty pregnant women who had prelabour rupture of membranes considered as group (1), other fifty pregnant women with intact membranes considered as group (2) through a period of one year. Nucleated red blood cell counts of venous cord blood obtained within

one hour of life from 50 infants who were born after prelabour rupture of membranes. The same procedure was applied for the control group.

**Results:** The nucleated red blood cell counts and Haematocrit were significantly higher in infants who were born after prelabour rupture of membrane than in the control group (P value <0.001 and 0.03 respectively).

**Conclusion:** Infants born after prelabour rupture of membrane have higher nucleated red blood cell counts at birth than the control group.

**Key words:** Prelabour rupture of membranes, nucleated red blood cells, haematocrit

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## **Introduction:**

**P**relabour rupture of membranes (PROM) defined as rupture of fetal membranes with leakage of amniotic fluid in the absence of uterine activity.<sup>(1)</sup> Pre-term PROM (PPROM) occurs when rupture of membranes occurs before 37 weeks gestation.<sup>(1)</sup> The length of latent period before onset of labour varies ranging from one to eight hours,<sup>(2)</sup> while prolonged rupture of membranes is usually defined as rupture of membranes more than 24 hours prior to delivery.<sup>(3)</sup> Incidence of PROM varies from 5-10% of all Pregnancies,<sup>(1)</sup> and 60% of which occur at term.<sup>(4)</sup>

Large number of clinical risk factors have been associated with prelabour rupture of membranes such as infection of upper genital tract<sup>(5)</sup>, smoking, vaginal bleeding especially if bleeding occurs later in pregnancy,<sup>(6)</sup> uterine overdistention by multiple pregnancy and polydramnious, intercurrent illness<sup>(7)</sup> and poor nutrition especially vitamin C deficiency.<sup>(8)</sup>

PROM should be confirmed by using sterile speculum examination<sup>(1,7,9)</sup>, investigated further by nitrazin test and ferning test.<sup>(1)</sup>

Nucleated red blood cells (NRBC) are immature erythrocytes which are characterized biochemically and

morphologically by their continuous synthesis and accumulation of hemoglobin molecules. Although NRBC are rarely found circulating in blood of older children, they are commonly seen in the blood of newborn babies<sup>(10)</sup>. In the first day of life these cells constituted about 500 NRBC/mm or 0.1% of the newborn circulating RBC<sup>(11)</sup>. Both acute and chronic fetal hypoxia/ischemia can increase NRBC counts<sup>(12)</sup>. Prolonged PROM may lead to cord compression and subsequently fetal hypoxia.<sup>(3,13)</sup> A consequence of intrauterine hypoxia is increased compensatory erythropoiesis due to increased erythropoietin secretion.<sup>(14,15)</sup> Elevated NRBC count is found in prematurity, anemia, maternal diabetes, maternal pregnancy induced hypertension, chorioamnionitis and postnatal hypoxia.<sup>(14,16)</sup>

**The aim of this study** was to examine circulating NRBC in infants born after PROM and compared to suitable controls.

## **Methods:**

A prospective study was conducted on (100) pregnant women with gestational age of 37 completed weeks or more attending department of obstetrics and Gynecology in AL-Kadhymia Teaching

Hospital for a period of one year (January 2006 - January 2007). The studied groups include (50) pregnant women presented with prelabour rupture of membranes (PROM) considered as group (1), and another (50) pregnant women with normal pregnancy considered as group (2) who were pair matched with group (1) with same gestational age ( $\pm 1$  week) and intact membranes.

In an attempt to control for the various variables known to affect NRBC counts, we excluded from the study infants born to women with preterm labour, Gestational or insulin-dependent diabetes, pregnancy induced hypertension, placental abruption or placenta previa, any maternal disease or other chronic conditions, smoking, perinatal infections (e.g. fever, leukocytosis, clinical signs of chorioamnionitis), any significant fetal heart abnormalities such as tachycardia, bradycardia, decreased variability or variable deceleration, or infants with low Apgar scores. Also we excluded infants with perinatal blood loss, hemolysis or chromosomal abnormalities. The duration of PROM was recorded depending on the history and the diagnosis confirmed by vaginal speculum examination  $\pm$  nitrazin and or ferning test.

All patients were followed during labour, after delivery and all infants were admitted to the nursery care unit for observation.

**Table 1:** Demographic and perinatal characteristics of infants with PROM and matched controls

	Gr.1 (n =50)	Gr.2 (n =50)	P- value	Significance
Gestational age(week)	38.3 $\pm$ 2.7	38.0 $\pm$ 1.9	0.93	N.S
Birth weight (g)	3436 $\pm$ 702	3578 $\pm$ 650	0.3	N.S
1 minute Apgar score	8 (7-9)	8 (7-9)	0.7	N.S
5 minute Apgar score	9 (8-10)	9 (9-10)	0.7	N.S
Perinatal death	0	0	-----	---

Data expressed as mean  $\pm$  SD or n%

Table 2 shows the hematological data obtained for group 1 and 2. There was no difference in term of lymphocyte count and platelet count. NRBC counts at birth and haematocrit were significantly higher in infants of group 1 (with PROM) than in group 2.

Within the first hour of life of each infant, 1 ml of umbilical cord venous blood was collected in ethylenediaminetetraacetic acid (EDTA) anticoagulated tube. A complete blood count was performed with MS 9 computer analyzer, a blood smear stained with Leishman's stain was prepared and the number of NRBC per 100 white blood cells was counted by a haematologist in the laboratory department of Al-kadhymia teaching hospital. NRBC counts were expressed as a percentage of white blood cells per cubic millimeter.

Data are collected and arranged in tables then subjected to statistical analysis using mean  $\pm$  standard deviation (SD), (%) or for none normally distributed variables (as NRBC or Apgar scores) as median and range. Back ward step wise regression analysis was used to assess the effect of gestational age, Apgar scores, and maternal characteristics with the PROM status as independent variables, with the NRBC counts as the dependent variables. P-value  $< 0.05$  was considered significant.

#### **Results:**

Table 1 shows the demographic and perinatal characteristics of infants with PROM and matched controls. There was no significant difference between group 1 and group 2 in term of birth weight, gestational age and Apgar scores.

**Table 2:** The hematological data of group 1 and 2

	Gr. 1 (n = 50)	Gr. 2 (n = 50)	P- value	Significance
Haematocrit	0.56 ± 0.08	0.51 ± 0.05	0.03	Significant
NRBC counts (X10 <sup>6</sup> /L)	1867(202 - 7780)	460 (0-1851)	< 0.001	Significant
lymphocyte counts (X10 <sup>9</sup> /L)	8.8 ± 4.5	8.0 ± 302	0.7	N.S
Platelets count (X10 <sup>9</sup> /L)	257 ± 100	272 ± 50	0.5	N.S

Data expressed as mean ± 1SD except for the none normally distributed data i.e. NRBC which expressed as median. N.S = not significant.

Table 3 shows the relation of NRBC counts to the duration of rupture of membranes. The NRBC counts increased with increase in the interval of rupture membranes to delivery.

**Table 3:** The relation between NRBC counts and duration of rupture of membranes.

PROM (hr.)	N = 50	NRBC
1 – 10	21	
11 – 20	10	870
21 – 30	5	1230
31 – 40	3	1860
41 – 50	2	2470
51 – 60	2	3080
61 – 70	4	4060
> 70	3	6345

Data expressed as median

### **Discussion:**

This study showed that prelabour rupture of membranes (PROM) especially if prolonged is significantly increase the nucleated red blood cells (NRBC) count in the cord venous blood of infant born after it (P value < 0.001). Additionally infant born after PROM also had increased haematocrit.

These results contrast with of redzko's *et al.* (2005) <sup>(17)</sup> who studied the relationship between the duration of labour, the mode of delivery, the duration of rupture of membranes and the haematological parameters including NRBC in cord blood in pregnant women who delivered term normal infants. They showed that the duration of rupture of membranes was not found to be influential upon NRBC counts. Redzko's study <sup>(17)</sup> is significantly different from ours in that the mean duration of rupture of membranes before delivery was approximately 5 hours,

which probably prevent the outliers of the study from determining the effect of prolonged rupture of membranes upon NRBC counts.

The mechanism by which PROM is associated with increased circulatory neonatal NRBC counts is unknown. A likely explanation is relative fetal hypoxia or ischemia. <sup>(18)</sup> In favor of a contribution of hypoxia and ischemia in pathogenesis of PROM is the fact that PROM is also associated with other indices of intrauterine hypoxia, such as necrotizing enterocolitis <sup>(19)</sup>, Fetal distress in labour, fetal acidemia, low Apgar score <sup>(20)</sup> and even cerebral palsy in PROM <sup>(21)</sup>.

Fetal hypoxia is believed to be due to fetal cord compression. In our study the presumed fetal hypoxia had been of sufficient duration leading not only to an increase in NRBC counts but also to an increase in haematocrit. The lymphocytes count also believed to be an indicator of

fetal hypoxia<sup>(22)</sup> was not elevated and the platelet counts did not decrease so these hematological parameters might indicate acute rather than chronic hypoxia.<sup>(18)</sup>

On the other hand, our data confirms that of Mccathy et. al. (2006)<sup>(23)</sup>, who found that the stress of uncomplicated labour does not change the level of NRBC, this add credence to its use as a marker for hypoxia preceding labour and delivery. The study involves 57 term singleton pregnancies, 33 with elective caesarean sections and 24 with vaginal deliveries. Umbilical cord blood was analyzed for NRBC counts and the results show the mean  $\pm$  SD for NRBC per 100 WBC from elective cesarean section group was  $7.8 \pm 7.4$ . The vaginal delivery group had mean value of  $9.3 \pm 10.5$  which was not significantly different.

#### **Conclusion:**

Infants born after prelabour rupture of membranes especially those with prolonged prelabour rupture of membranes at term have higher cord blood nucleated red blood cells (NRBC) count at birth.

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