Significance of Umbilical Cord Nucleated Red Blood Cells Count in Overdue Pregnancy

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ABSTRACT:

BACKGROUND:

Elevated count of nucleated red blood cells (n-RBCs) in the cord blood of fetuses at birth as well as prolongation of pregnancy, have been suggested as predictor of adverse perinatal outcome.

OBJECTIVE:

A prospective cohort study to evaluate the association between umbilical cord nucleated RBCs (uc-nRBC) count in uncomplicated overdue pregnancies with their neonatal outcome.

PATIENTS & METHODS:

One hundred and eighty five ladies with overdue pregnancy (41-42 weeks+3days) were included in the study. Dating was confirmed by their precisely recalled last menstrual periods and early pregnancy sonographies. At their deliveries, umbilical cord nucleated red blood cells were counted and expressed per 100 white blood cells. Mode of delivery, the newborn outcome and the risk factors were all analyzed with the obtained counts of the n-RBCs using descriptive and inferential statistics.

RESULT:

The number of n-RBCs counted, ranged from 3-43/ 100 WBC and accordingly the cases were categorized into 3 groups. Those with more than 20 n-RBC/100 WBC (high risk group) showed higher incidence of neonatal risk outcomes (49.3% of the calculated total risks) than the group with 3-10 n-RBC (low risk group) which included about half of the participants, it exhibited only 20.5% of the total risks. The risk outcomes include; meconium staining, admission to neonatal intensive care unit, neonatal death and Apgar score at 7 minutes less than 5. Moreover, cesarean section rate in high risk group was almost double its rate in the low risk group (44.7% Vs 22.5%).The association between risk outcome and n-RBC counts is statistically highly significant P value < 0.001.

CONCLUSION:

In overdue pregnancy, umbilical cord n-RBC count of the new born is significantly associated with risk outcome.

KEY WORDS: nucleated red blood cells (n-rbc), prolonged pregnancy and neonatal outcome.

INTRODUCTION:

When pregnancy prolonged; there is a gradual decrease in fetal hemoglobin with a rise in adult hemoglobin which has lower oxygen affinity, so oxygen saturation in the umbilical circulation diminishes from 70% at 30 weeks to 60% at term and further fall to 30% at 43 weeks [1]. Besides the likelihood for development of placental insufficiency when pregnancy is prolonged [2]. All these factors may critically add to the anoxia state responsible for perinatal complication.

Nucleated red blood cells are immature erythrocytes found in the umbilical and peripheral circulation of newborns. They are primarily produced in the fetal bone marrow in response to erythropoietin and when elevated reflects a state of acute or chronic hypoxic fetal environment and often regarded as a predictor of adverse perinatal outcome [3, 4].

In 1942, lippman [5] first reported nRBCs in the blood of newborns in their first day of life. He claimed the normal count of about 500 n-RBCs/ mm^3 or 0.1% of the newborns' circulating RBCs. Since then, many investigators have reported similar values by using manual counting and recently, automated approaches have been developed in order to quickly and accurately quantifying the n-RBCs [6]. In normal neonate, n-RBCs are rapidly cleared from the blood soon after birth. By 12hrs of age, the count falls by

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about 50% and no n-RBCs are found after the third or fourth day of life [5, 7].

The study aimed to highlight reflection of the umbilical n-RBC counts per 100 WBC on the risk outcome of the neonates in overdue and prolonged pregnancy

MATERIAL AD METHODS:

One hundred and eighty five pregnant ladies with overdue but uncomplicated pregnancy (41 - 42 Week + 3 days) were enrolled during their attendance to the obstetric department at Al-Elwiya Maternity Teaching Hospital seeking for management during the period between January 2006 and June 2007.

The demographic and obstetric data were recorded on a special form for each participant after taking their consent. Gestational age determination was based on precisely recalled menstrual date and further confirmed by their first or early second trimester ultrasound.

Multiple gestations and pregnancy complications such as diabetes mellitus, hypertension, pre-eclampsia, intrauterine growth restriction and Rh isoimmunization were excluded.

At admission to the labour ward, complete obstetric examination was done as well as full assessment of the patient's general condition.

Laboratory analysis

At delivery, umbilical cord venous blood sample was taken after cord clamping and collected immediately into ethylenediaminetetraacetic acid (EDTA) K3 tubes to be analyzed with an automated hematology cell-counting machine (Bayer, Tarrytown, NY). Blood smears were stained with Wright stain using Hamatek 2000 (Bayer) for study.

With an experienced laboratory technician at the hospital, using a light microscope, the nucleated red blood cells were manually counted and expressed per 100 white blood cells [8, 9].

Classification and statistical analysis

According to the nucleated RBC counts, the cases were classified in to three groups.

Group 1 (Eighty nine babies) represents those with 3- 10 n-RBC, ***group 2*** (Fifty eight babies) with 11-20 n-RBC, while group 3 (Thirty eight babies) with more than 20 (20-53 n-RBC/100 WBC).

Beside labour-delivery details, the neonatal outcome including meconium staining, Apgar score <7 at 5 minutes, Neonatal Intensive Care Unit (NICU) admission and neonatal death were recorded as risk outcome.

The Data obtained were arranged in tables and subjected to statistical analysis with minitab program. Descriptive statistics (tables, frequency and percentage) were done. Inferential statistics include x2 test and P value less than 0.05 considered as significant and less than 0.001 as highly significant.

RESULTS:

The mean gestational age of the participants was 41.7 weeks (range 41-42 days +3 days). The median n-RBC count / 100 WBC was 13 (range 3-43) and the mean was 18.

Table 1, shows the mode of delivery of the participants. The recorded total caesarian section rate was 25.95%. It is highest among group 3 with a rate of 44.7% which is double the rate seen in group 1 (22.5%). While vaginal delivery was the mode of delivery of more than two third of those in the low risk group. On the other hand, Instrumental delivery rate (Ventose and low cavity forceps) was not much different in all groups.

The association between type of delivery and n-RBC counts is shown to be statistically significant with P value = 0.038

Table 2, shows the neonatal risk outcome in the three groups. Some babies had multiple risk outcomes. Meconium staining (thin or thick) is the most prevalent risk outcome among the included babies (39%), followed by admission to intensive neonatal care unit (32.2%) and Apgar score less than 5 at 7 minutes (26.7%).

Any transient admission to neonatal unit for less than 24 hours was excluded from the statistics and most common causes for admission were respiratory distress and convulsion.

When comparing the three groups; it is evident that group 1 had the least incidence of risk outcome (20.5%) with meconium staining occupying top of the risks affecting 17.97% of the babies followed by low Apgar score (7.9%), neonatal admission (6.74%) while group 3, carries most of the risk (49.3%). Two third of the babies (63.15%) in this group required long neonatal admission, more than two third of them 71%) had meconium staining and half suffered from Apgar score of less than 5 at 7 minutes. Interestingly, group 2, had risk outcomes intermediate between the groups.

The association between risk outcome and n-RBC counts is statistically highly significant P value < 0.001.

Table 1: Method of delivery

		Group 1	Group 2	Group 3
Total	Intervention	3-10 n-RBC/100 WBC	11-20 n-RBC/100 WBC	> 20 n-RBC/100 WBC
48 25.95%	Caesarian section	20 22.5%	11 19%	17 44.7%
21 11.35%	Instrumental delivery	9 10.1%	7 12%	5 13.2%
116 62.7%	Vaginal delivery	60 67.4%	40 69%	16 42.1%
185	Total	89 48.1%	58 31.35%	38 20.55%

P value = 0.038, x2 = 10.180, DF = 4

Table 2: Neonatal outcome (some neonates have multiple risk factors)

		Group 1 3-10 n-RBC	Group 2 11-20 n-RBC	Group 3 >20 n-RBC	P value
Total	Risk outcome	89 baby	58 baby	38 baby	< 0.001
39 26.7%	*Apgar score Less than 5	7 7.9%	13 22.41%	19 50%	< 0.001
57 39%	**Meconium staining	16 17.97%	14 24.13%	27 71%	< 0.001
47 32.2%	***Neonatal admission	6 6.74%	17 29.31%	24 63.15%	< 0.001
3 2.1%	Neonatal death	1 1.12%	0	2 5.26%	…….
146	Total risk outcome	30 20.5%	44 30.13%	72 49.3%	0.008

*Apgar score at 7 minutes less than 5 **Thin and thick meconium ***Neonatal admission for more than 24 hours

DISCUSSION:

Intrauterine asphaxia harms the newborn. It stimulates an over production of erythropoiten and hemopoiesis. This processs will allow the immature nucleated RBCs to unusual appear in peripheral blood [10] and some regarded the level of n-RBCs counts correlate with both acute and chronic antepartum asphaxia. It can be used as reliable index of early neonatal outcome [8].

Moreover, prolonged pregnancy is generally regarded a good reason for the hypoxic environment embracing the fetus, Axt et al [11] who have studied 43 postterm patients and 261 controls reported a significant increase in uc-nRBC counts in post term deliveries (median 6.5, range 0-24 versus median 3.7, range 0-14; p< .05) but Perri et al [9] concluded that elevated n-RBC counts associated with specific pregnancy complication rather than uncomplicated prolonged pregnancy.

Because no pregnancy with medical or obstetrical complications is satisfactorily allowed to be post-term, so it is very uncommon to handle women suffering from both prolonged and complicated pregnancy when studying the significance of n-RBC count and its association with the neonatal outcome. Besides the fact that the traditional practice in our hospital (like in many other centers) is to interfere by induction when pregnancy is progressed beyond 41 weeks, so genuine post term pregnancy (beyond completed 42 weeks) is also not common.

Caesarian sections were done to the participants when abnormal fetal heart monitoring or mechanical reasons encountered. Because mode of delivery couldn't be blamed as a unique reason for elevating

the n-RBC count, probably, same potential reason could be blamed for increasing both cesarean section rate (44.6%) and n-RBC count (> 20) in the high risk group as clarified in the tables. Actually, no significant difference in n-RBC count between elective cesarean group and vaginal delivery group according to the results obtained by Mccarthy JM et al (12). When calculating the neonatal risk outcomes we found that group 3 (> 20 n-RBCs) represented the high risk group because half of the total risk outcomes were recorded in this group, while the group in whom n-RBCs ranged from 3-10 / 100 WBCS is regarded as the low risk group, as clarified in table 2.

CONCLUSION:

Umbilical cord n-RBCs count, when exceeds 20 per 100 WBC, is significantly associated with increasing incidence of neonatal risk outcome.

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