Mode of Delivery and Cord Blood Hematocrit

Basil M. Hanoudi
CABP

Abstract:

Background: The hematocrit (Hct) is one of the important tests of cord blood indices, it is an indicator of both the mean corpuscular volume and red blood cell count and it is influenced by many fetal, placental, maternal and environmental factors.

Objective: To find out the effect of mode of delivery on cord blood hematocrit.

Subjects & Methods: The study was done on 246 live born neonates; all were delivered at term, their birth weight ranging between 2.5-4.6Kg. We excluded infants of smoking mothers, infants with meconium-stained amniotic fluid, dysmorphic, infants of diabetic mothers and infants with intrauterine growth retardation or multiple gestation pregnancy outcomes.

All mothers were healthy, non-anemic, and all pregnancies were uncomplicated.

Only infants with APGAR scores above 7 at 1 and 5 minutes were included in the study. Case group was divided into; Group one included vaginal delivered(VD) infants, group two included elective cesarean section(CS) delivered infants, while group three included infants delivered by cesarean section because of arrest of descent.

Blood was collected from the umbilical vein and tested for hematocrit and hemoglobin.

The study was carried out in three maternity hospitals (Ibn Al-Baladi hospital, St. Raphael hospital and Al-Hayat maternity hospital in Baghdad) over a Four months period (1st of February--30th of May 2005).

Results: Mean birth weight of the study group was 3.349 Kg (+/-0.479). The males: females were 130:116.Repeated CS was the commonest indication of elective CS deliveries**.**

The mean birth weight and median APGAR scoring at one and five minutes did not differ significantly in the three groups**,** there was a significant difference in gestational age in-between elective CS group and the two other groups(P value <0.001) by approximately one week.

Mean cord hematocrit was not significantly different in two CS groups, but was significantly lower than VD group (P value <0.001). While sex, birth weight, gestational age or APGAR scoring had no significant influence on cord Hct.

Conclusion: Differences in blood volume and plasma volume in infants of cesarean section deliveries and those delivered by normal vaginal delivery would make the mode of delivery an important predictor of venous cord blood hematocrit.

Key words: Hematocrit, Cord blood hematocrit, Mode of delivery.

Introduction:

The hematocrit(Hct) is the percent of whole blood that is composed of red blood cells, and it is measured by the following equation (Hct = Mean Corpuscular Volume x Red Blood Cell Count)[1]. There are differences in blood volume and plasma volume in infants of cesarean section deliveries and those delivered by normal vaginal delivery which are reflected on hematocrit level.

The shifting of blood from the umbilical cord and placenta[2] to the newborn's circulation and the shifting of intravascular fluids to the extravascular spaces[3,4,5] are important factors in making these significant differences between normal vaginal delivery and cesarean section deliveries regarding cord blood hematocrit.

Hematocrit is an important parameter of newborn's well-being, and it undergoes significant changes in the early postnatal life. As the central venous hematocrit rises postnatally, there will be an increased viscosity and decreased blood flow[6]; when the hematocrit increases to more than 60%, there will be a fall in oxygen transport[7,8].

Newborns have erythrocytes that are less deformable than adults and as viscosity increases, there will be an impairment of tissue oxygenation and decreased glucose in plasma and a tendency to form microthrombi. If these events occur in the cerebral cortex, kidneys or adrenal glands then a significant damage may occur [9, 10].

Subjects & Methods:

A cross sectional study designed to examine the correlation of Mode of delivery with cord blood hematocrit.

The study was done on 246 live born neonates; all neonates were delivered at term (37-41 completed weeks of gestation, from last menstrual period, confirmed by ultrasound study and use of Ballard score examination at birth), their birth weight ranging in-between 2.5-4.6Kg[11]. We excluded infants of smoking mothers, neonates with meconium-stained amniotic fluid, dysmorphic, neonates with congenital anomalies, infants of diabetic mothers and infants with intrauterine growth retardation or multiple gestation pregnancy outcomes.

All mothers were healthy, non-anemic (Hemoglobin was >=10gr/dl during third trimester) [12, 13, 14], and all pregnancies were uncomplicated.

In all mothers, fetal heart monitoring was normal during labor and prior to cesarean section delivered mothers.

Only neonates with APGAR scores above 7 at 1 and 5 minutes were included in the study. Case group was divided into; Group one included vaginal delivered(VD) infants (spontaneous vertex vaginal delivery), group two included cesarean section(CS) delivered infants (because of either repeated caesarian section, maternal request, breech presentation, maternal genital herpes or cephalopelvic disproportion), while group three included infants delivered by cesarean section because of arrest of descent (failure to deliver after 3 hours in primiparous women or 2 hours in multiparous women during the second stage of labor).

Umbilical cord was clamped early(within 15 second from delivery), no stripping of the cord was done, with the baby held at same level of the mother. Blood was collected from the umbilical vein in a double-clamped segment of the umbilical cord. EDTA collecting tubes and capillary hematocrit tubes were used to estimate blood hematocrit and hemoglobin, a micro- hematocrit was measured by centrifugation of a capillary hematocrit tubes at 11000 rpm for 5 minutes, using a Biofuge centrifuge (Heraeus Instruments, Germany), and Drapkin's method for hemoglobin measurement.

Neonatal birth weight was measured soon after delivery by using a Seca scale for weight sensitive to 10gm.

The study was carried out in three maternity hospitals (Ibn Al-Baladi hospital, St. Raphael hospital and Al-Hayat maternity hospital in Baghdad) over a four months period (1st of February-30th of May 2005).

All results were expressed in numbers and percentages, the statistical analysis was done using t test.

Results:

The study group included 246 newborns, with mean birth weight was 3.349Kg (+/-0.479) Kg. The males: females were 130:116, mean birth weight was3. 422Kg (+/-0.496): 3.249 Kg (+/-0.441) respectively, with (P value <0.001).

Repeated CS was the commonest cause of elective CS as seen in table 1

Table 2 illustrates the demographic data of neonates delivered by vaginal delivery, elective cesarean section and cesarean section due to arrest of descent; have shown that there was a highly significant difference in gestational age in-between elective CS group and the two other groups(P value <0.001) by approximately one week.

The mean birth weight and median APGAR scoring at one and five minutes did not differ significantly in the three groups (P value >0.05).

Table 1: Indications of elective CS in Group two.

Indications of elective CS in Group two	Group two	
	No.	%
Repeated CS	81	70.43
Breech presentation	15	13.04
Maternal request	9	7.82
Cephalopelvic disproportion	8	6.95
Maternal genital herpes	2	1.73
Total	115	100

Table 2: Newborn's number, sex, birth weight, and gestational age, Apgar score at 1 min and at 5 min distribution in group 1, 2 and 3.

	Group one	Group two	Group three	Total
No. of newborn (%)	87(35.36)	115(46.74)	44(17.88)	246
(Male: Female)	39:48	63:52	28:16	130:116
Birth weight in Kg Mean(+/-SD)	3.336(0.460)	3.355(0.485)	3.341(0.479)	3.344(0.479) [P value=0.105]
Gestational age in weeks Mean(+/-SD)	39.58(0.75)	38.51(0.42)	39.94(0.62)	39.10(0.85) [P value < 0.001]
APGAR score 1 min Median(range)	9(8-10)	9(8-10)	9(8-10)	9(8-10) [P value=0.152]
Apgar score 5 min Median(range)	10(9-10)	10(9-10)	10(9-10)	10(9-10) [P value=0.073]

Mean cord hematocrit was not significantly different in two CS groups, but was significantly lower than VD group(P value <0.001), and mean cord hemoglobin was not significantly different in two CS groups, but was significantly lower than VD group(P value <0.001) as seen in table 3.

While newborn's sex, newborn's birth weight, gestational age or Apgar scoring had no significant influence on cord Hct (P value >0.05) as shown in table 4.

Table 3: shows cord blood hematocrit and hemoglobin in the three groups.

	Group one	Group two	Group three	P value
Cord blood hematocrit% Mean(+/-SD)	50.99(3.26)	44.90(2.67)	47.36(2.25)	<0.001
Cord blood hemoglobin g/dl Mean(+/-SD)	16.98(3.24)	14.97(2.66)	15.77(2.23)	<0.001

Table 4: Correlation of sex, birth weight, gestational age and Apgar scoring with mean Hct level in group 1, 2 and 3.

		Group one		Group two		Group three		P Value
		No.	Mean Hct	No.	Mean Hct	No.	Mean Hct	
Sex	**Male**	39	51.01	63	44.91	28	47.32	0.091
	Female	48	51.99	52	44.90	16	47.40	
Birth weight	2.50-3.49Kg	40	51.01	54	44.89	20	47.38	0.152
	3.50-4.6Kg	47	50.95	62	44.94	22	47.18	
Gestational age	38-39Wk	37	51.02	67	45.00	23	46.98	0.108
	40-41Wk	50	50.95	48	44.99	21	47.45	
Apgar score m_1*	8/10	11	50.97	16	44.88	9	47.32	0.264
	9/10	21	51.01	22	44.90	25	47.36	
	10/10	83	50.98	77	44.94	10	47.37	
Apgar score m_5**	9/10	6	51.02	9	45.07	10	47.68	0.243
	10/10	81	50.97	106	44.86	34	47.71	

* **Apgar score minute one,** ** **Apgar score minute five**

Discussion:

The mean birth weight in the study group was 3.349Kg (+-0.479) Kg, which is closely similar to 3.4Kg by Needlman [14].

There was a significant positive correlation of newborn's male sex with newborn's birth weight (P value <0.001), which is similar to findings of Dattani and Preece [11], and Needlman [15].

In our study, women who delivered by elective CS had a slightly (1 week), but significantly lower gestational age than mothers in the two other groups.

Apgar score was almost similar in the three groups, a finding probably related to the strict selection of the cases.

The current data indicate that cord blood hematocrit in C/S delivered infants of either group is lower than in infants delivered by vaginal delivery, which goes with the concept of lower infant's blood volume in CS deliveries[2,4], a higher blood volume at birth in VD infants[2,6] and probably a shifting of intravascular fluids to the extravascular space which has already been started in utero and explaining the differences at birth, alternatively; a lower hematocrit level in CS-delivered infants may indicate a higher plasma volume[5].

Studies on total body water in CS-delivered infants have shown that total body water is higher in VD infants [5]; however this increase in total body water appears to be only at the expense of intracellular water.

Similar levels of hematocrit and hemoglobin in both groups of CS delivered infants indicate that the early and correct decision of CS delivery(went through the first stage of labor and a small period of the second stage of labor) which makes no significant difference between the two groups levels of hematocrit and hemoglobin, and the significantly higher level in VD infants makes it clear that the shift of fluids took place in the later stages of labor, and it explains the little higher level of hematocrit and hemoglobin in group three over group two due to the effect of first stage of labor and a the small period of the second stage of labor on body fluids[3,5,16].

Sex, birth weight, gestational age and Apgar scoring were found not to have significant correlation with cord blood hematocrit, a finding similar to Lubetzky and Carmi [16, 17].

Conclusions & Recommendations:

Mode of delivery determines neonatal hematocrit significantly, and thus it is important to know the mode of delivery before evaluating cord blood hematocrit results.

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From pediatr Dept. Coll. of Med. Al-Mustansiriya Univ.