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Comparison of the Frequency of Neonatal Anemia in Early Versus Delayed Cord Clamping in Infants at Term

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Authors' Contributions

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ABSTRACT

Introduction: There has been a long-running debate about the best time to clip the umblical cord. There are no established standards for "early" or "late" cord clamping. There are a wide range of approaches concerning at what time the umbilical cord should be compressed, ranging from within 60 seconds after delivery to more than 60 seconds after birth or with the cessation of umblical cord pulsations

Objectives: To compare the incidence of newborn anemia in term infants who had their cords clamped early against those who had their cords clamped later.

Methods and Materials: Pregnant women who were at 37 to 41 weeks' gestation were included in the study. Diabetic mother's infants, IUGR and PROM were not considered. Early cord clamping (cord clamping within 15 seconds of birth) was performed in category A infants, while delayed cord clamping (cord clamping after 3 minutes of birth) was performed in category B. Blood samples (in ml) from all neonates in both study categorys were taken at the 6th hour after cord clamping and sent to the laboratory for hematocrit level assessment, and anemia was found in both categorys**.**

Results: The mean age of patients in category A was 25.65 ± 4.10 years, and the mean age of patients in category B was 27 ± 4.04 years. The mean gestational age was 39.31 weeks with a standard deviation of 1.46 weeks. The mean parity was 3.34 ± 1.11, which is a rather high result. Among the 236 newborns, there were 133 males and 103 females, with a male to female ratio of 1.3:1. Neonatal anemia was more common in category A (early catheter clamp) than in category B (late catheter clamp), with a p value of 0.002 between the two.

Conclusion: Compared to delayed cord clamping, newborn anemia is more common after early cord clamping in term neonates.

Keywords: *cord clamping, delayed, anemia.*

INTRODUCTION

During birth, the amount of blood from the placenta that reaches the baby is known as placental transfusion [1, 2]. Placental circulation carries 1.25% to 60% of total fetal-placental blood volume (54-160 ml), as well as 60% of fetal red blood cells and hematopoetic stem cells [3]. Allowing post-birth placental transfusion will raise the newborn's blood volume by 30 percent [4]. Addition of plasma and red

cell mass (40-50 mg/kg of body weight) results in an increase in iron [5]. A 2011 study found that the maximum volume of placental transfusion is between 24 and 32 ml/kg of body weight, or an additional 30% to 40% of blood volume, for neonates with the cord still intact [6]. An earlier study found that after just three minutes, the placenta provided 22.5 ml/kg, or an additional 32% blood volume, to the fetus [7]. In addition, it appears that net placental flow to the baby ceases after two minutes of delivery [6]. Umbilical cord clamping timing, gravity, uterotonic agent delivery (such as oxytocin), and cord milking are all thought to affect the amount of blood given to the newborn. The umbilical cord keeps the newborn connected to the placenta until birth. Clamping the cord with two clamps and cutting between the clamps is the standard procedure for separating the newborn from the placenta. The time between the baby's birth and the placenta's delivery is known as the third stage of labor, and it is during this stage that this task is performed. In a recent World Health Organization (WHO) report, active treatment of the third stage of labor has been defined as the "cornerstone" of obstetrics and midwifery practices in the later half of the twentieth century [8, 9]. The use of uterotonic drugs, early cord clamping and cutting, and controlled umbilical cord traction have all been used by clinicians as part of active management during placental delivery. Since the 1970s, cord clamping has been a hotly debated topic. There are no established standards for "early" or "late" cord clamping. There are a wide range of policies regarding when the umbilical cord should be clamped, ranging from 60 seconds after delivery to more than 60 seconds after birth or when the cord's pulse has stopped [10]. Infant hemoglobin deficiency can be prevented by delaying the umbilical cord clamping [11]. Delaying the clamping of the umbilical cord permits the placenta to deliver fetal blood to the newborn. An additional 40% of the baby's blood volume can be provided by this placental transfer. There are a number of factors that affect blood flow to a newborn during a cesarean section, including when and where it is performed [12]. Increased placental transfusion benefits the fetus by increasing hemoglobin concentrations, increasing iron reserves, and reducing anemia in early infancy [12, 13]. The frequency of anemia between early and delayed umbilical cord clamping was determined to be 13% and 4%, respectively, according to a study [14]. Among our population's infants, anemia is a common occurrence, which increases mortality and impairs cognitive development. For this reason, I set out to undertake a study to assess the occurrence of newborn anemia among infants delivered at term with early versus delayed cord-clamping. Because the majority of our population lives in the countryside, where quacks and traditional birth attendants tend to handle most cases, the findings of this study will be helpful in establishing routine practice guidelines for reducing neonatal anemia by providing all health care providers and clinicians with the appropriate time for cord clamping.

MATERIALS & METHODS

It was a randomized controlled trial that took place from October 13th 2021 to April 12th, 2022 at the Obstetrics and Gynecology Department of Bahawal Victoria Hospital in Bahawalpur. If the estimated frequency of anemia between early and delayed umbilical cord clamping is discovered to be 13 percent and 4 percent, the computed sample size will be 236 (118 in each category) with a margin of error of 5 percent and an 80 percent power of study [14].

SAMPLE SELECTION:

a. Inclusion Criteria:

- All infants delivered at term (gestational age 37-41 weeks as assessed on LMP) of both genders.
- Women between 18-40 years of age.
- Singleton pregnancy.
- Parity of 1 to 5.

b. Exclusion Criteria:

- Multiple pregnancy (assessed on ultrasonography).
- Antepartum hemorrhage (history of vaginal bleeding in mother as assessed on medical record).
- Infant of diabetic mother (as assessed on history and medical record).
- Intrauterine growth retarded babies (weight<2.5kg).
- Premature rupture of membranes >18 hours (assessed on medical record)

Data Collection Procedure:

A total of 236 newborns born in the Obstetrics and Gynecology Department at Bahawal Victoria Hospital in Bahawalpur who met the Inclusion criteria were chosen with the approval of the CPSP. The parents of infants were asked for written agreement. Two categorys of infants, A and B, were randomly generated from the entire sample of infants. Early cord clamping (cord clamping within 15 seconds of birth) was performed in category A infants, while

delayed cord clamping (cord clamping after 3 minutes of birth) was performed in category B. In both categorys, blood samples (in ml) were collected and sent to the institution's laboratory for hematocrit level determination at the 6th hour of cord clamping, and anemia was reported as per the operational definition of anemia. On a specially developed proforma, all of this information (the mother's age, gestational age, parity, gender of the newborn, location of residence, and monthly income) was recorded (Annexure-I).

Statistical Analysis:

SPSS version 20 was used for statistical analysis. Quantitative factors, such as the mother's age, the gestational age of the baby and the mother's hemoglobin level, were provided as the mean and standard deviation. It was determined how often and how much each of these qualitative variables (gender, place of residence, income) occurred, as well as how often and how much each of these variables occurred. The difference in newborn anemia between the two categories was examined. To compare the prevalence of anemia, researchers used Chi Square. Statistical significance was defined as a p-value of 0.05 or less. A post-stratification chi square was used to examine the impact on anemia frequency of effect modifiers such as maternal age, gestational age, parity, mother's hemoglobin levels, neonate's gender, and location (rural/urban). The hematocrit levels of the infant and monthly income (15000/15001-35000/>35000) were also examined.

RESULTS

The age range for this study was 18 to 40 years, with a mean age of 26.82 ± 4.06 years. The mean age of patients in category A was 25.65 ± 4.10 years and in category B it was 27.67 ± 4.04 years. The majority (84.32%) of the 199 patients were between 18 and 30 years of age, as shown in Table **1**.

Table 1. Distribution of patients according to Age, Gestational age, Parity, hemoglobin levels of mother, hematocrit levels of infant, place of living, monthly income, for both categoryss (n=236).

Age (years)	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
18-30	105	88.98	94	79.66	199	84.32
31-40	13	11.02	24	20.34	37	15.68
Mean ± SD	**25.65 ± 4.10**		**27.67 ± 4.04**		**26.82 ± 4.06**	
Gestational age for both categorys (n=236).						
Gestational age (weeks)	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
37-39	52	44.07	61	51.69	113	47.88
40-41	66	55.93	57	48.31	123	52.12
Mean ± SD	**39.42 ± 1.50**		**39.19 ± 1.45**		**39.31 ± 1.46**	
Distribution of patients according to parity in both Categorys						
Parity	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
1-3	70	59.32	68	57.63	138	58.47
4-5	48	40.68	50	42.37	98	41.53
Mean ± SD	**3.19 ± 1.18**		**3.54 ± 1.02**		**3.34 ± 1.11**	
Distribution of patients according to hemoglobin levels of mother						
Hb (g/dl)	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
≤10	31	26.27	28	23.73	59	25.0

>10	87	73.73	90	76.27	177	75.0
Mean ± SD	**11.27 ± 1.17**		**11.32 ± 1.04**		**11.31 ± 1.09**	
Distribution of patients according to hematocrit levels of infant						
Hematocrit levels	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
≤50	53	44.92	48	40.68	101	42.80
>50	65	55.08	70	59.32	135	57.20
Mean ± SD	**50.25 ± 2.30**		**50.36 ± 2.24**		**50.32 ± 2.26**	
Distribution of patients according to place of living						
Place of living	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
Rural	62	52.54	66	55.93	128	54.24
Urban	56	47.46	52	44.07	108	45.76
Distribution of patients according to monthly income						
Monthly income	**Category A (n=118)**		**Category B (n=118)**		**Total (n=236)**	
	No. of patients	%age	No. of patients	%age	No. of patients	%age
≤15000	32	27.12	41	34.75	73	30.93
15001-30000	55	46.61	46	38.98	101	42.80
>30000	31	26.27	31	26.27	62	26.27

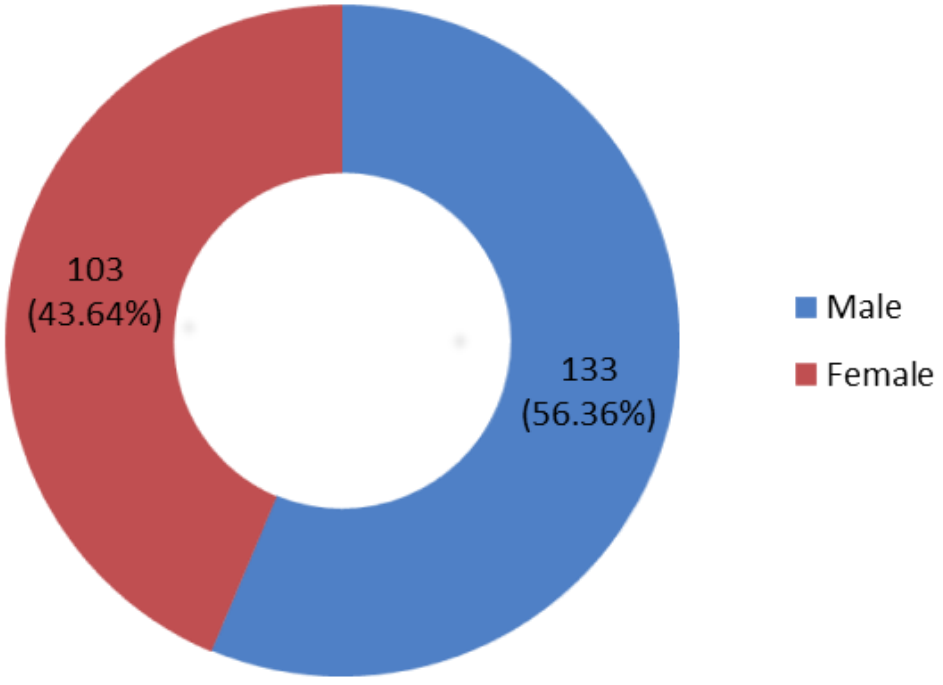

Figure 1. Distribution of patients according to Gender of neonate (n=236).

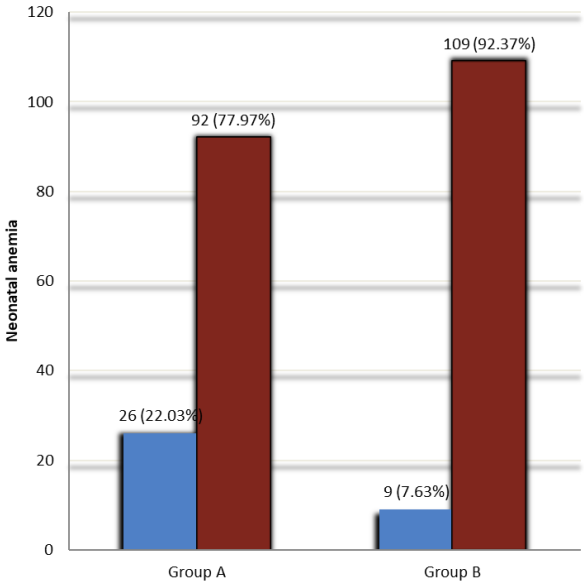

Figure 2. Frequency of neonatal anemia in early versus delayed cord clamping in infants at term.
P-value = 0.002 which is statistically significant

Table 2. Stratification of neonatal anemia with respect to age Categorys, gestational age, parity, gender of baby, hemoglobin levels of mother, hematocrit levels of infant, place of living and monthly income.

Age of patients (years)	Category A (n=118)		Category B (n=118)		P-value
	Neonatal anemia		Neonatal anemia		
	Yes	No	Yes	No	
18-30	24	81	09	85	**0.012**
31-40	02	11	00	24	**0.048**
Stratification of neonatal anemia with respect to gestational age					
GA (weeks)	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
37-39	11	41	06	55	**0.093**
40-41	15	51	03	54	**0.006**
Stratification of neonatal anemia with respect to parity					
Parity	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
1-3	17	53	05	63	**0.007**
4-5	09	39	04	46	**0.117**
Stratification of neonatal anemia with respect to gender of baby					
Gender of baby	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
Male	13	49	07	64	**0.074**
Female	13	43	02	45	**0.007**

Stratification of neonatal anemia with respect to hemoglobin levels of mother					
Hb of mother	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
≤10	08	23	02	26	**0.056**
>10	18	69	07	83	**0.014**
Stratification of neonatal anemia with respect to hematocrit levels of infant					
hematocrit levels of infant	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
≤50	17	36	03	45	**0.001**
>50	09	54	06	64	**0.298**
Stratification of neonatal anemia with respect to place of living					
Place of living	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
Rural	11	51	03	63	**0.017**
Urban	15	41	06	46	**0.045**
Stratification of neonatal anemia with respect to monthly income					
Monthly income	**Category A (n=118)**		**Category B (n=118)**		**P-value**
	Neonatal anemia		**Neonatal anemia**		
	Yes	No	Yes	No	
≤15000	05	27	02	39	**0.122**
15001-30000	14	41	05	41	**0.062**
>30000	07	24	02	29	**0.071**

The mean gestational age was 39.31 ± 1.46 weeks. As shown in Table **1**, the mean gestational age was 39.42 ± 1.50 weeks in category A and 39.19 ± 1.45 weeks in category B. The mean parity was 3.34 ± 1.11. As shown in Table I, the equality was 3.19 ± 1.18 for category A and 3.54 ± 1.02 for category B.

Among the 236 newborns, 133 were males (56.36%) and 103 were females (43.64%), with a male to female ratio of 1.3:1, as shown in Figure **1**.

Mean maternal Hb (Table I) and neonatal hematocrit (Table **1**) were 11.27 ± 1.17 and 50.25 ± 2.30 and 50, 36 ± 2.24 in Category A (DCC category) and Category B (ECC category), respectively. The distribution of patients by place of residence and monthly income is shown in Table **1**.

The incidence of neonatal anemia was 26 (22.03%) and 09 (7.63%) in category A (early clamp) compared with category B (late clamp) (Figure II), with a p-value of 0.002.

Neonatal anemia by age category, gestational age, and number of deliveries is presented in Table II. Table **2** shows the stratification of neonatal anemia by sex.

Neonatal anemia depends on maternal hemoglobin level and neonatal hematocrit level, see Table II. Table **2** shows that the incidence of neonatal anemia depends on the place of residence and monthly income.

DISCUSSION

The umbilical cord is the only thing keeping the fetus connected to the placenta throughout pregnancy. Allows for the development of neuro-motor and overall fetal development, as well as the connection to the mother's body and feto-maternal interface [15]. When a baby is born, the umbilical cord is cut and a stump is left behind, which should dry and fall off within 5 to 15 days [16] This practice of delaying the

umbilical cord compressing until 2-3 minutes afterward birth or until the cord pulses have stopped has been adopted by the American Academy of Pediatrics and will result in significantly more placental blood transfusion than if the cord clamping is performed immediately after delivery [8, 17] If the obstetrician forgets or the chord needs to be clamped right away because of fetal distress or difficulties during delivery, delaying cord clamping may not be an option [18-22]. Roughly 80ml of placental blood is transferred to the newborn within the first minute of delivery, rising to about 100ml within three minutes. This research was done to assess the incidence of newborn anemia in term infants who had an early cord clamping versus a delayed cord clamping. The mean age of my study participants was 26.82 years with a standard deviation of 4.06 years. The mean age of class A was 25.65±4.10 years old, and the mean age of class B was 27.67±4.04 years old. The mean gestational age was 39.31 weeks with a standard deviation of 1.46 weeks. Among the 236 newborns, there were 133 males and 103 females, with a male to female ratio of 1.3:1. There were 26 cases of neonatal anemia in category A (early umbilical cord ligation), and 9 cases in category B (late umbilical cord ligation). According to one study, the anemia rate between early and late bone clamping was determined to be 13% and 4%, respectively [14]. Early cord clamping at 15 seconds leads to anemia (haematocrite 45 percent) and clinical outcomes at term, according to a study [23]. This study compared early cord clamping with delayed umbilical cord clamping by 3 minutes at 6 hours of life. Compared to neonates whose umbilical cord clamping was delayed by three minutes, 8.9% of those who had their umbilical cords clamped early had anemia by the sixth hour of life [23].

Mitra et al. in 2009 found that the newborn Hb in the DCC group was 17.41.0 vs. 16.141.1 at 6 hours of birth, and 16.30.9 vs.15.60.9 at 48 hours of birth, respectively [24]. Hematocrit levels were 52.53.1 vs. 48.52.9 (ECC) in the DCC group at 6 hours of birth and 49.43.6 vs. 46.72.0 at 48 hours of birth, according to the same study [24]. The DCC group had a mean hematocrit differential of 3.1 1.7 compared to an ECC group difference of 1.8 1.5. 23 Early and delayed cord clamping had the same amount of bleeding and the same length of the third stage of labor (Mean: 203.52 122.74 ml for early and delayed cord clamping, respectively), according to a separate study. Early and delayed clamping resulted in infant hemoglobin levels of 11.07 1.27 gm/dl and infant hematocrit levels of 34.13 3.93 percent, respectively (p=0.0000). 115 Of the 540 newborns studied (including 281 boys (52% of the total) and 259 girls (48% of the total; mean gestational age, 39.2 weeks [SD]), 270 were randomly assigned to one of two clamping schedules. In the delayed group, 212 infants (78.5 percent) and 188 (69.6 percent) returned for blood sample at 8 months of age. According to multiple regression analysis, infants with late clamp had higher hemoglobin levels (10.4 g/dL vs 10.2 g/dL; difference 0.2 g/dL; 95% confidence interval 0.1 to 0.4 g/dL). At 8 months, 197 (73.0%) of 197 infants with skeletal delay had hemoglobin levels below 11.0 g/dL and 222 (82.2%) infants had hemoglobin levels below 11.0 g/dL. (Relative risk, 0.89; 95% CI, 0.81-0.98; number needed to treat [NNT], 11; 95% CI, 6-54). The risk of iron deficiency was reduced by 22.2% in the delayed clamp group compared with 38.1% in 8-month-old patients (relative risk, 0.58; 95% CI, 0.44-0.77; NNT 6, 95% CI, 4)- 13). Delaying cord clamping for an additional 12 months increased hemoglobin levels by 0.3 g/dL (95% CI, 0.04-0.5) and anemia risk by 0.91 g/dL (95% CI, 0.84-0.98). resulting in an NNT of 12 (95% CI, 7-78) [(25)]. According to one study [26], children in the DCC group also had higher mean hemoglobin levels after 24-48 hours (18.5 vs 17.1 g/dl, respectively). However, in several trials, the mean hemoglobin level at 2 to 3 months or 4 to 6 months of age was not significantly different [27, 28].

CONCLUSION

This study found that the risk of newborn anemia is greater when the umbilical cord is clamped early than when it is clamped later. Consequently, we urge that we use delayed umbilical cord clamping to prevent infant anemia.

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