

# Effect of Delayed Cord Clamping on Hemoglobin Level among Newborns in Rajiv Gandhi Government Women & Children Hospital, Puducherry

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**Abstract** Introduction-Anemia is one of common disorders not only in adults but also found in infants too. In developing countries, prevalence of Iron Deficiency Anemia (IDA) is highest. Up to 50% of children become anemic by 12 months of age. A first step towards reducing anemia in infancy can be taken during birth is Delayed cord clamping that makes use of readily available blood from the fetoplacental compartment, estimated roughly 120 ml/kg of fetal weight. These additional volumes of blood can supply extra iron amounting to 40–50 mg/kg of body weight. When this extra iron is added to the approximately 75 mg/kg of body iron that a full-term newborn is born with, the total amount of iron can reach 115–125 mg/kg of body weight, which may help prevent iron deficiency during the first year of life. Objectives-To compare the hemoglobin level at birth & 24 hours after birth in both the Group I (cord was clamped within 15 seconds of birth) and Group II (clamped at 3 minutes) newborns. To correlate the cord clamping time with the Hemoglobin level of the term newborns. Methodology-Experimental design was adopted. 61 newborns (Group I – 30 and Group II- 31), selected through simple random sampling. Standardized. Sahli's Hemoglobin meter was used to estimate the Hemoglobin from the cord blood at birth and capillary blood obtained by heel stick at 24 hours from the Newborns. Result and findings-The mean hemoglobin levels at birth and at 24 hours were 17.75 gms%  $\pm$  1.567 and 19.97 gms%  $\pm$  1.511, 16.97 gms%  $\pm$  1.134 and 19.59 gms%  $\pm$  1.395 for Group I and II respectively. The calculated 't' values (5.644 and 7.599 at birth and 24 hours) shows there is highly significant difference between Group I and II Hemoglobin levels. There was a positive correlation ( $r = 0.591$  at birth and  $r = 0.4198$  at 24 hours) found between cord clamping timing and the hemoglobin level. Conclusion-Delayed clamping group has higher range of hemoglobin levels at birth and 24 hours, therefore delayed clamping can be considered to improve the hemoglobin levels in newborns.

**Keywords:** Haemoglobin, anaemia, newborns, cord clamping

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## 1. Introduction

"Delayed clamping adjourns anemia in infants"

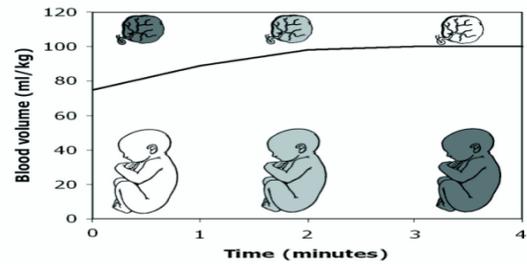
Anemia is one of common disorders not only among the adults but also in children and infants too. In developing countries, prevalence of Iron Deficiency Anemia (IDA) is highest among children aged less than five years. It is estimated that around 50% of children become anemic by the age of 12 months [1,2,3,4]. Risk factors for iron deficiency include low birth weight and maternal iron deficiency during pregnancy [5], became the major contributor to infant mortality. Iron Deficiency Anemia has been associated with impaired cognitive development in children less than five years of age. These children fail to catch up with iron therapy. Strategies to reduce Iron Deficiency Anemia in infants include iron

supplementation and iron fortification. Although these measures have been shown to be clinically effective, they are either cost-ineffective or difficult to implement, especially in developing countries [6].

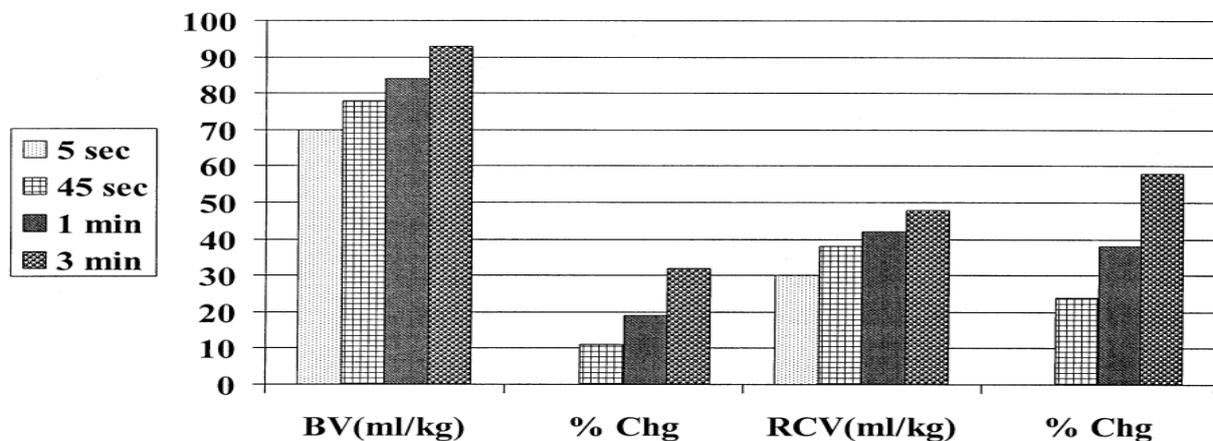
Iron deficiency anemia during infancy and childhood is of particular concern because of potentially detrimental effects on development, some of which might be irreversible even after iron treatment [7,8]. Prevention of iron deficiency and anemia during infancy is therefore a priority. However, the types of interventions that can be implemented during this time are limited. A first step towards reducing anemia in infancy can be taken during birth. Delayed cord clamping or placental transfusion could be a cost-effective intervention to improve the iron status of infants by enhancing their red cell mass [9]. It is estimated that the total fetoplacental blood volume is roughly 120 ml/kg of fetal weight. After immediate cord

clamping the distribution of blood reflected in the fetus: placenta ratio is approximately 2:1. When allowing placental transfusion to occur for three minutes results in a larger fetal blood volume (ratio 5:1) [10]. After three minutes, the transfer of blood will stop with approximately 20 ml/kg of blood remaining in the placenta. Compared with immediate clamping, a clamping delay of 3 minutes provides an additional 20-35 ml/kg of body weight. These additional volumes of blood can supply extra iron amounting to 40-50 mg/kg of body weight. When this extra iron is added to the approximately 75 mg/kg of body iron that a full-term newborn is born with, the total amount of iron can reach 115-125 mg/kg of body weight, which may help prevent iron deficiency during the first year of life [11]. Further Delayed clamping allows time for a transfer of the fetal blood in the placenta to the infant at the time of birth. As Figure 2 shows, "placental transfusion" can provide the infant with an

additional 30% more blood volume and up to 60% more red blood cells, the only oxygen-carrying component in the body. Both are lost with immediate cord clamping [12,13].



**Figure 1.** Distribution of blood in fetoplacental compartment depending of timing of cord clamping (Figure adopted from the book- The role of delayed umbilical cord clamping to control infant anemia in resource-poor settings, by Rhenen.P.V, 2007)



**Figure 2.** Percent change in blood volume and cell volume caused by delayed cord clamping. BV-blood volume; RCV-red cell volume

## 2. Objectives of the Study

1. To estimate the cord blood hemoglobin among the Group I newborns, where the cord was clamped within 15 seconds of birth.
2. To estimate the cord blood hemoglobin among the Group II newborns, where the cord was clamped at 3 minutes after birth or immediately after cessation of cord pulsation.
3. To estimate the hemoglobin level at 24 hours after birth in both Group I (cord clamped within 15 seconds) and Group II newborns (cord was clamped at 3 minutes after birth or immediately after cessation of cord pulsation).
4. To compare the level of Hemoglobin among the study groups (I, II)
5. To correlate the cord clamping time with Hemoglobin level of the term newborns.
6. To associate the Hemoglobin level of term newborns of study groups (I, II) with their selected demographic variables.

## 3. Assumption

Delaying the cord clamping time after birth may increase the amount of blood transfused from placenta to

newborn and thereby increase the hemoglobin level in newborn.

## 4. Hypothesis

H<sub>1</sub>. There will be significant difference between Hemoglobin level of Group I and Group II newborns at birth.

H<sub>2</sub>. There will be significant difference between Hemoglobin level of Group I and Group II newborns at 24 hours.

H<sub>3</sub>- There will be significant correlation between cord clamping time and Hemoglobin level.

H<sub>4</sub>- There will be significant association between Hemoglobin level and selected demographic variables.

## 5. Methodology

Quantitative research approach and true Experimental Design with two groups was adopted for this study [14,15]. The present study was conducted in Rajiv Gandhi Government Women and Children Hospital, Puducherry, Sample size was calculated with the power analysis, test of difference between two means was obtained from the previous study and with the help of the formula ( $\gamma = \mu_1 - \mu_2 / \sigma$ ) the effect size was calculated (0.80). Further according to the power of 0.80 and effect of 0.80 the

sample size was 25 per group. Hence the total sample was 50. But keeping the dropouts in the mind 10% extra sample for study was considered and taken as 60. The total sample size was 61 term infants- 30 in group I (cord clamped within 15 seconds of birth) and 31 in group II (cord clamped at 3 minutes of birth or immediately after cessation of pulsation). Due to dropouts during 24 hours intervention, the final sample size remained 26 in group I and 29 in group II. The reason for dropouts were mother not willing for heel prick procedure and baby got admitted in newborn nursery during the follow up. Therefore, the total sample at 24 hours follow up was 55 newborns. The inclusion criteria were, term newborns born, babies having APGAR 8/10 or above at birth, Mothers having Hemoglobin greater than or equal to ( $\geq$ ) 10 gm/dl at the time of delivery. Babies born to mothers with any complications like PIH, GDM, twins, polyhydramnios, oligohydramnios, heart disease, anemia, preterm labour.etc, and babies with any complications or disorder were excluded from study. The sampling technique was Simple random sampling. The tool had two sections: Section A had 2 parts for collecting demographic variables of mother and baby. Section B had checklist for mean hemoglobin and timing of cord clamping (Table 1). Hemoglobin level at birth and 24 hours was estimated by using standardized sahli's hemoglobin meter. Reliability of the tool was checked by inter rater reliability and the obtained 'r' value was 0.87 found reliable.

**Table 1. Check list for the mean hemoglobin and timing for cord clamping**

Cord clamped < 15 seconds		Cord clamped at 3 minutes or immediately after cessation of cord pulsation	
At birth	After 24 hours	At birth	After 24 hours

### 5.1. Data Collection Procedure

After getting formal permission and ethical clearance, the researcher conducted the study at Rajiv Gandhi Women and Children Hospital, Puducherry. The study was done for one month period from 13.01.2012 to 11.02.2012. Data collection was done in two areas. In labour room, during birth to check the hemoglobin level for two groups. There after follow up data collection was carried out in the postnatal ward after 24 hours of birth to estimate the hemoglobin level in both the study groups. Before starting Data collection the newborn babies were selected randomly to two study groups based on the inclusion criteria. Written informed consent was obtained from all the mothers willing to participate in the study. Then the cord clamped according to the group identified and hemoglobin level was estimated from the cord blood. The second set of data (hemoglobin level) was collected after 24 hours of birth from both the study groups by heel stick procedure. The heel stick procedure was carried out in the presence of qualified and approved Pediatrician in Rajiv Gandhi Women and Children Hospital, Puducherry.

## 6. Result and Findings

The distribution of demographic variables of the mothers shows that majority of the mothers 25 (83.33%) and 26 (83.87%) were in the age group of 18-25 years, 23

(76.66%) and 21 (67.74%) were completed secondary/higher secondary level of education, 21 (70%) and 20 (64.52%) gave birth for the first time, 12 (40%) and 13 (41.94%) mothers had more than 12gms% Hb from Group I and Group II respectively .

With regard to demographic distribution of the newborn highlights that 15 (50%) and 19 (61.29%) subjects were males and about 15 (50%) and 12 (38.71%) of samples were females, 12 (40%) and 17 (54.84%) samples had birth weight of 2.5-3 kg, in Group I and Group II respectively (Table 2).

**Table 2. Distribution of Demographic Variables of Newborns**

DEMOGRAPHIC ARIABLES	GROUP I N=30		GROUP II N=31	
	NO.	%	NO.	%
SEX				
a. Male	15	50%	19	61.29%
b. Female	15	50%	12	38.71%
BIRTH WEIGHT				
a. < 2.5 kg	1	3.33%	2	6.45%
b. 2.5- 3 kg	12	40%	17	54.84%
c. 3. 1- 3.5 kg	11	36.67%	9	29.03%
d. 3.5- 4 kg	5	16.67%	3	9.68%
e. > 4 kg	1	3.33%	0	0

The mean hemoglobin level of subjects at birth as  $17.15 \pm 1.56$  and  $19.97 \pm 1.51$  in Group I and Group II respectively. The calculated 't' value was 5.644, shows there is highly significant difference ( $p < 0.000$ ) between Group I and Group II Hemoglobin levels. (Table 4). Hence H1 is accepted. The mean hemoglobin level of Samples at 24 hours as  $16.97 \pm 1.13$  and  $19.59 \pm 1.39$  in Group I and Group II respectively. The calculated 't' value was 7.599, shows there is highly significant difference ( $p < 0.000$ ) between Group I and Group II Hemoglobin levels. (Table 3). Hence H2 is accepted. There is a positive correlation ( $r = 0.591$  at birth and  $r = 0.4198$  at 24 hours of birth) found between delayed cord clamping and the hemoglobin level, (H3 is accepted). The variables parity and gravida shows significant association ( $p < 0.05$ ) with the haemoglobin level at 24 hours after birth in group I newborns whereas the variable mothers haemoglobin level was found significant association ( $p < 0.05$ ) with the haemoglobin level at 24 hours after birth in group II newborns. Hence H4 is rejected except the above variables.

**Table 3. Comparison of Hemoglobin Level at Birth between Two Groups**

Group	Mean	SD	't' value and 'p' value	level of significance
I	17.75	1.567	t = 5.644 p = 0.000***S	H1 is accepted
II	19.97	1.511		

**Table 4. Comparison of Hemoglobin Level at 24 Hours between Two Groups**

Group	mean	SD	't' value and 'p' value	level of significance
I	16.97	1.134	t = 7.599 p = 0.000***S	H2 is accepted
II	19.59	1.395		

## 7. Discussion

The study revealed that the hemoglobin levels in the Group I were less than the hemoglobin levels in the Group II. There was significant difference of hemoglobin levels at birth ( $17.75 \pm 1.56$  &  $19.97 \pm 1.51$  for gr I & II respectively) and at 24 hours ( $16.97 \pm 1.23$  &  $19.59 \pm 1.39$  for gr I & II respectively). Since the delayed clamping group had higher range of hemoglobin levels, delayed clamping can be considered to improve the hemoglobin levels in subjects. There are many benefits of delayed cord clamping including prevention of neonatal anemia. Approximately 40% of the fetal cardiac output goes to the placenta per minute, whereas 8% to 10% goes to the fetus' lungs. There is a dramatic change in the blood flow to the lung from 8% of the cardiac output in fetal life to 45% immediately after birth. Immediate cord clamping limits access to the blood volume [12,13]. Emhamed, M. O et.al [16], 2004, conducted a study to evaluate the hematological "effects of the timing of umbilical cord clamping in term infants" 24 hours after birth in Libya. 104 Mother-infant pairs were randomly assigned to early cord clamping (within 10s after delivery, n=46.) or delayed clamping (after the cord stopped pulsating, n=58). Infant hematological status was evaluated in cord blood and 24 h after birth. The mean infant hemoglobin level was significantly higher in the delayed clamping group (18.5 g/dL versus 17.1 g/dL;  $P=0.0005$ ). This result supports the present study result. Shirvani.F et.al [17], 2010 conducted a study to evaluate the hematological "effects of umbilical cord clamp timing on newborn's iron status and its relation to delivery type" in term infants 48 hours after birth in Iran. Hundred mother-infant pairs were divided into two groups: early cord clamp time within 15 s (n=70) or delayed cord clamp time [15 s after delivery (n=30)]. The mean infant hemoglobin (Hgb; 16.08 gm/dL vs. 14.5 gm/dL;  $P<0.001$ ) and hematocrit (Hct 47.6 vs. 42.8;  $P<0.001$ ) levels were significantly higher in the delayed clamping group.

McDonald, S. J. and P. Middleton [11], 2008 studied on "the Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes". They included 11 trials of 2989 mothers and their babies. Their analysis showed significant increases in newborn hemoglobin levels in the late cord clamping group compared with early cord clamping (weighted mean difference 2.17 g/dL; 95% CI 0.28 to 4.06; 3 trials of 671 infants). Infant ferritin levels remained higher in the late clamping group than the early clamping group at six months. Ultee C.A et al [18], 2008, conducted a study on "delayed cord clamping in preterm infants with two groups, gr I cord clamped within 30 sec and gr II at 3mins". Haemoglobin level was determined at 1hour and 10weeks, reported that there was higher Hb level among the delayed group than early group i.e 13.4(1.9) vs 11.1(1.7) at 1 hour and 6.7(0.75) vs 6(0.65) at 1 week for delayed and early gr respectively. Andersson et.al [19], 2011 studied the "Effect of delayed versus early umbilical cord clamping on neonatal outcomes and iron status at 4 months: a randomized controlled trial". 400 full term infants were randomized to delayed umbilical cord clamping (3 minutes after delivery) or early clamping (> 10 seconds after delivery). The result shows that there was significant difference in the level of ferritin between the

groups at 4 months. The study also supported by many other studies conducted by the researchers [20-30]. They found that delayed cord clamping resulted in improved iron status. The Pan American Health Organization released new recommendations favoring delayed cord clamping over immediate cord clamping. This intervention has not only been proven effective, but it is cost-free, making it a particularly appropriate and sustainable intervention for low-resource areas of the world.

## 8. Conclusion

Clamping and cutting of the umbilical cord at birth is the oldest and most prevalent intervention in humans. In spite of that, the optimal timing of cord clamping has been a controversial issue for decades (Eileen K. Hutton & Eman S. Hassan, 2007). It is a safe, simple and low cost delivery procedure that should be incorporated in integrated programs that are aimed at reducing iron deficiency anemia in infants in developing countries. Vaginal delivery facilitates this action [17,30].

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