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Research Article

### IMPACT OF EARLY VERSUS DELAYED CLAMPING ON SERUM FERRITIN LEVEL OF NEWBORN; 48 HOURS AFTER BIRTH

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**Abstract:**

**Background:** Iron deficiency and iron deficiency anemia are major public health problems in young children worldwide, and are associated with poor neurodevelopment. Delayed umbilical cord clamping has been suggested as a measure to prevent infant iron deficiency, but we lack data concerning its health benefits and possible adverse effects, especially in the developing world.

**Objective:** To evaluate the effect of early versus delayed clamping on the serum ferritin level of newborn; 48 hours after birth

**Methodology:** This prospective cohort was conducted upon a sample of 400 mother-infant pairs scheduled to undergo delivery at Indus Medical College, Hospital from January 2018 to December 2018. The mother-infant pairs were randomly assigned to delayed clamping (2 min after delivery of the infant's shoulders) or early clamping (around 10 s after delivery). Primary outcomes were infant hematological status and iron status at 48 hours after birth. The data obtained was recorded onto a structured questionnaire and analyzed using SPSS v.21 & Microsoft Excel 2016.

**Results:** The mean age of the mothers stood at 34 (SD ± 4.9). Maternal hematological status was assessed upon admission to the delivery room. The groups had similar demographic and biomedical characteristics at baseline. 200 infants were born vaginally and 200 were delivered by cesarean section. Forty-eight hours after delivery the mean infant hemoglobin, hematocrit and serum ferritin levels were significantly higher in the delayed clamping group versus the early clamping group.

**Conclusion:** After careful consideration, it can be concluded that delaying cord clamping increases the red cell mass in term infants. 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.

**Keywords:** Iron Deficiency, Vaginal Delivery, Umbilical Cord Clamping, Serum Ferritin & Red Cell Mass.

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**INTRODUCTION:**

Iron deficiency and iron deficiency anemia are major public health problems in young children worldwide, and are associated with poor neurodevelopment. Delayed umbilical cord clamping has been suggested as a measure to prevent infant iron deficiency, [1] but we lack data concerning its health benefits and possible adverse effects, especially in the developing world.

Young children are at particular risk of iron deficiency because of high iron requirements during rapid growth in combination with low iron intake. Globally, about a quarter of preschool children have iron deficiency anemia, the most severe form of iron deficiency. In Europe, the prevalence of iron deficiency anemia is 3–7% among young children, and the prevalence of iron deficiency has been reported to be as high as 26%. [2] Iron is essential for several aspects of brain development, including myelination, dendrite-genesis, neurotransmitter function, and neuronal and glial energy metabolism. [3]

Iron deficiency anemia in young children is associated with long lasting cognitive and behavioral deficits. [7, 8] Iron deficiency without established anemia has also been associated with altered affective responding, impaired motor development, and cognitive delays. [4, 5] Two recent meta-analyses have concluded that iron supplementation improves psychomotor and mental development in infants and children. [6, 7] Thus, the available evidence suggests that it is important to prevent iron deficiency in infants in order to achieve optimal brain development.

During the first minutes after birth, the newborn infant may receive a substantial blood transfusion from the placenta. A term newborn held 10 cm below the level of the uterus during the first three minutes of life increases its blood volume by an average of 32%. [8] Delayed cord clamping, usually defined as ligation of the umbilical cord 2–3 minutes after birth or when cord pulsations stop, will thus result in a larger placental transfusion than early cord clamping performed immediately after delivery. [9]

Only a few controlled trials have assessed effects of delayed cord clamping on infant health. Some studies even suggest that delayed cord clamping may have adverse neonatal effects with increased risk of respiratory symptoms, [10] polycythemia, [11] hyperbilirubinemia, [12] and need of phototherapy. [13] Thus the debate regarding whether early or delayed cord clamping is preferable, rages on.

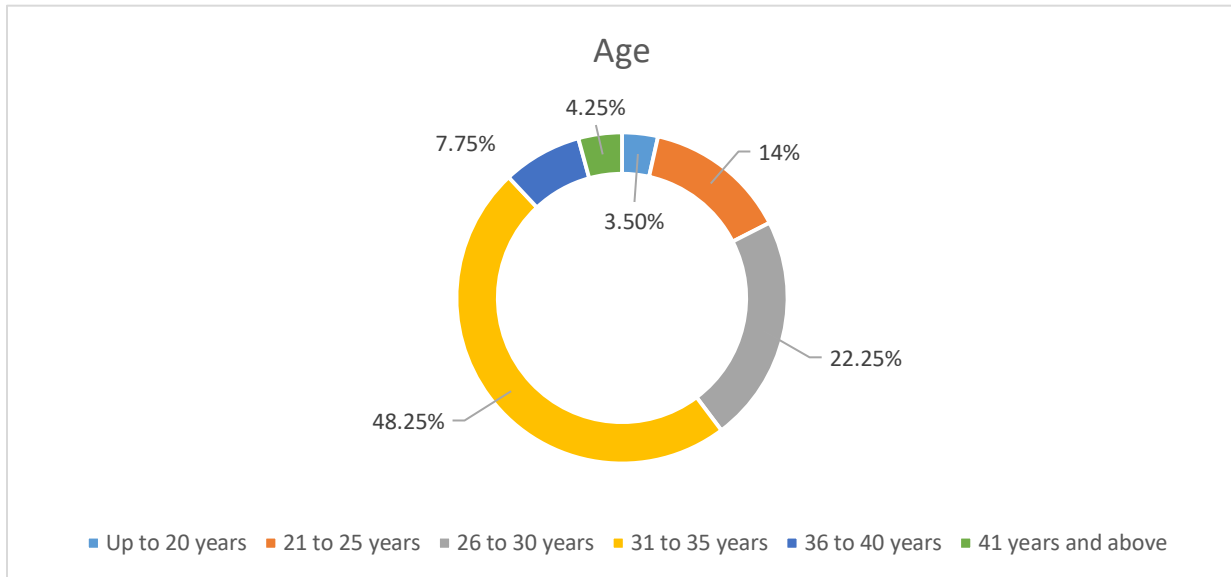
A recent survey showed large differences in cord clamping practices, both between and within countries, with early cord clamping being the dominating practice. [14] We therefore undertook this prospective cohort to compare the effects of delayed and early cord clamping on serum ferritin level and other hematologic parameter such as hemoglobin level, 48 hours after birth in healthy, term infants.

**METHODOLOGY:**

This prospective cohort was conducted upon a sample of 400 mother-infant pairs scheduled to undergo delivery at Indus Medical College, Hospital from January 2018 to December 2018. The mother-infant pairs that undergo delivery by either vaginal or cesarean section from uncomplicated pregnancies (mothers without eclampsia, preeclampsia, severe heart or renal disease, severe antepartum hemorrhage, Hb greater than 10 gm/dL, and no history of more than five deliveries) were randomly assigned to delayed clamping (2 min after delivery of the infant's shoulders) or early clamping (around 10 s after delivery). Newborns were included if there were no twin or asphyxiated deliveries, no first 24 hours after birth icterus, no congenital malformations, no hyaline membrane or respiratory distress syndrome, no sepsis, birth weight <2000 g or gestational age <35 weeks. In order to Primary outcomes were infant hematological status and iron status at 48 hours after birth. The data obtained was recorded onto a structured questionnaire and analyzed using SPSS v.21 & Microsoft Excel 2016.

**RESULTS:**

Among, the 400 mother-infant pairs enrolled into the study, the mean age of the mothers stood at 34 (SD  $\pm$  4.9).



Maternal hematological status was assessed upon admission to the delivery room. The groups had similar demographic and biomedical characteristics at baseline. 200 infants were born vaginally and 200 were delivered by cesarean section.

Forty-eight hours after delivery the mean infant hemoglobin was Hgb; 16.08 gm/dL in the delayed clamp group and vs. 14.5 gm/dL in the early clamp group. There was also a difference in ferritin levels (214.7 vs. 173.6 ng/dL).

Variable		Early Clamping	Delayed Clamping
Newborn Hemoglobin	Mean $\pm$ SD	14.3 $\pm$ 2.1	16.5 $\pm$ 2.3
	Range	11 – 17.8	13 – 18.2
Newborn Hematocrit	Mean $\pm$ SD	42.3 $\pm$ 7.2	47.6 $\pm$ 4.2
	Range	31 – 55.2	34 – 61
Newborn Ferritin	Mean $\pm$ SD	171.9 $\pm$ 77.1	261.5 $\pm$ 108
	Range	31 – 392	40 – 669

### DISCUSSION:

Based on the cord clamping time, this study showed a significant difference between newborn Hb and HCT 48 hours after birth. The equivalence of the groups at baseline (maternal age, weight, Hgb, number of live children, neonatal birth weight and gestational age) support the conclusion that the effect may be casual. Significant higher ferritin levels and Hb concentrations have been reported in newborns born with the Leboyer method of delivery (neonates placed on their mothers' abdomens, whose cords were clamped once pulsation ceased). [14]

Studies in India and Guatemala in addition to other well-designed, well-executed randomized trials have shown higher venous HCT levels six hours after birth and the sustained effect of late clamping has been demonstrated by other indicators of infant hematologic status (iron stores and ferritin) at age six

months. [15, 16] This investigation was not undertaken in our study. Similarly, in the preterm population, late clamping has shown some potential benefits in terms of the decreased need for blood transfusion and lower risk of intraventricular hemorrhage as well as a reduced need for packed red cell transfusion 24 hours to 6 weeks after birth. [17, 18]

Other uncontrolled studies, particularly in India and China, have shown no significant hematological differences between groups three to six months after birth. [19, 20] The majority of trials did not adequately address the hematologic status of recruited mothers as a potential confounder in the relationship between clamping interval and risk of anemia during infancy. [21]

We assessed mothers' Hb levels in the two groups. The complications of late cord clamping, such as the increase in hyper-viscosity, stroke volume, heart rate, cardiac output, and left to right shunt across the ductus arteriosus are still controversial. [18] Accordingly, there is no evidence of any significant harm as measured by the need for phototherapy to treat jaundice or by admission to the NICU. [22]

The volume of placental blood transfusion depends on the time of clamping and the position in which the infant is held prior to clamping and is estimated at approximately 35 mL/kg of birth weight or 32% of blood volume in a term infant kept at vaginal level with the cord clamped three minutes after birth or once pulsation ceased (Leboyer delivery). [23, 24] One important issue is the possibility of overlap between the timing definitions of late and early cord clamping.

In this study, the mean difference in cord clamping was 13.9 s and no additional practices, such as neonatal positioning, were concomitantly used. With multivariate-regression analyses, the differences among the early and late groups in HCT and HB levels 48 hours postpartum remained significant. Also significant, was the difference in ferritin levels between the two groups.

In this study, in 50% of the cases were delivered vaginally and 50% delivered by cesarean section. Most infants in cesarean section group had delayed cord clamping. Delivery type can affect the time for cord clamping. Cesarean sections are performed in an operating room and the duration of cord clamp depends on the surgical procedure and cannot be delayed because of surgical complications to the mother (hemorrhage and infection). Elimination of this limitation gives permission to prolong this time manually in vaginal delivery; this can be another benefit of vaginal delivery as opposed to a cesarean section

### CONCLUSION:

After careful consideration, it can be concluded that delaying cord clamping increases the red cell mass in term infants. 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.

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