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Original Article

Comparison of Early and Delayed Umbilical Cord Clamping in Term Neonates

Rakesh Sharma[1], Tushar Dashora[2*]

[1,2]Assistant Professor, Department of Pediatrics, NIMS Medical College & Hospital, NIMS University, Jaipur, Rajasthan, India.

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***Correspondence to:**
Dr. Tushar Dashora, Assistant Professor, Department of Pediatrics, NIMS Medical College & Hospital, NIMS University, Jaipur, Rajasthan, India.

ABSTRACT

Background: The interval between birth and interruption of umbilical blood flow represents an important procedural decision that can influence early neonatal circulatory adaptation and maternal outcomes. While immediate cord clamping has historically been integrated into standard delivery protocols, increasing empirical evidence has prompted reconsideration of delayed cord clamping as a practice with potential advantages related to neonatal circulatory stability and overall perinatal outcomes.

Aim: This study examined differences between delayed and early umbilical cord clamping with respect to neonatal hemoglobin levels, bilirubin outcomes, and postpartum maternal blood loss.

Materials and Methods: This prospective comparative study included 100 term deliveries randomly assigned to early cord clamping (within 30 seconds) or delayed cord clamping (after 2–3 minutes). Neonatal hemoglobin and bilirubin levels were measured at 24 and 48 hours postnatally, while maternal blood loss was estimated using changes in postpartum hemoglobin levels.

Results: Delayed cord clamping significantly increased neonatal hemoglobin levels and reduced anemia. Bilirubin levels were mildly higher, with a slight rise in phototherapy-treated jaundice. Maternal blood loss and postpartum hemorrhage rates were comparable between groups.

Conclusion: Delayed cord clamping improves neonatal iron status with an acceptable increase in jaundice risk. In view of its benefits, DCC may be adopted as routine practice with appropriate monitoring for neonatal hyperbilirubinemia.

KEYWORDS: Delayed Cord Clamping; Early Cord Clamping; Postpartum Blood Loss; Neonatal Jaundice.

INTRODUCTION

Decisions made during the moments immediately following birth can have measurable physiological consequences for both the newborn and the mother. One such decision involves the interval between delivery of the infant and interruption of placental circulation. Although rapid separation of the umbilical cord has long been embedded in routine delivery protocols, growing interest has focused on the effects of allowing placental circulation to continue briefly after birth[1,2].

Allowing placental circulation to persist briefly after birth facilitates additional placental transfusion, thereby increasing neonatal blood volume during the early phase of postnatal adaptation[3,4,5,6]. This augmented circulatory volume has been associated with higher hemoglobin concentrations and more robust iron availability during early infancy[7,8]. Sufficient iron availability in early infancy has been associated with favorable growth patterns and neurodevelopmental outcomes, particularly in settings where infant anemia is common.

At the same time, prolonging placental transfusion may alter bilirubin dynamics in the neonatal period. An increase in red cell mass following enhanced placental transfusion may lead to greater bilirubin generation as part of normal erythrocyte breakdown, thereby increasing the likelihood of neonatal jaundice[9,10]. This balance between hematological benefit and bilirubin-related risk continues to generate clinical debate, especially in healthcare environments with limited neonatal monitoring capacity.

Maternal safety considerations have also influenced discussions regarding cord clamping practices. Concerns have been raised that delaying cord interruption might interfere with normal uterine contraction and placental separation, potentially increasing postpartum blood loss. However, available evidence indicates that variations in the timing of cord clamping do not substantially affect maternal hemorrhagic outcomes when deliveries are managed according to established obstetric standards[11,12].

In light of these competing considerations, the present investigation seeks to examine how different cord clamping intervals influence neonatal hemoglobin status, the development of neonatal jaundice, and maternal blood loss after delivery. By addressing both neonatal and maternal parameters, this study aims to contribute clinically relevant evidence to inform safe and balanced approaches to cord clamping[13].

MATERIALS & METHODS

Study Design and Participants:

This prospective comparative study included one hundred women who delivered at term at the National Institute of Medical Sciences, Jaipur. Participants meeting the inclusion criteria were randomly allocated into two equal groups according to the timing of umbilical cord clamping, with fifty women assigned to early cord clamping and fifty to delayed cord clamping.

Inclusion criteria

- Pregnancies involving a single fetus positioned longitudinally with the head presenting
- Births accomplished through vaginal or surgical routes without peri-operative complications
- Individuals who agreed to participate after providing written informed authorization

Exclusion criteria

- Births occurring prior to or beyond the term gestational window
- Pregnancies with more than one fetus
- Maternal conditions likely to influence outcomes, including pregnancy-related hypertension, glucose intolerance disorders, or moderate to severe anemia
- Newborns identified with major structural abnormalities or requiring immediate intensive resuscitative care
- Deliveries associated with excessive maternal bleeding or conditions predisposing to postpartum hemorrhage

Procedures

Immediate Umbilical Cord Interruption:

Discontinuation of placental–neonatal circulation was performed within the initial 30-second interval following birth[1,2], after which physical separation of the cord was completed.

Deferred Umbilical Cord Interruption:

Continuation of placental blood flow was permitted for an interval of approximately two to three minutes after delivery or until pulsatile activity within the cord was no longer detectable, at which point cord separation was undertaken.

Assessment of neonatal physiological adaptation was carried out through quantification of hemoglobin concentration and serum bilirubin at 24 hours and 48 hours after birth. Evaluation of maternal blood loss was achieved indirectly by analyzing postpartum changes in hemoglobin concentration, complemented by clinical appraisal of bleeding severity and identification of postpartum hemorrhage where present.

RESULTS

Data from one hundred term births were included in the final analysis, with equal distribution between the two study groups based on the timing of umbilical cord interruption. No statistically significant differences were identified in baseline maternal or neonatal characteristics, indicating group comparability ($p > 0.05$).

Newborns exposed to deferred interruption of placental circulation demonstrated higher hemoglobin values at both assessment points. At 24 hours after birth, mean hemoglobin levels were 17.8 ± 1.4 g/dL in the deferred group compared with 15.9 ± 1.3 g/dL in the immediate interruption group. This hematological advantage persisted at 48 hours (17.2 ± 1.5 g/dL versus 15.4 ± 1.2 g/dL), with the observed differences reaching statistical significance ($p < 0.001$). In addition, the proportion of neonates classified as anemic was lower among those who underwent deferred cord interruption (4%) compared with the immediate interruption group (18%), ($p = 0.03$).

Analysis of bilirubin parameters revealed slightly elevated mean serum bilirubin concentrations in the deferred group at both time points. At 24 hours, bilirubin levels averaged 6.1 ± 1.2 mg/dL compared with 5.2 ± 1.1 mg/dL in the immediate group, while at 48 hours the corresponding values were 8.3 ± 1.6 mg/dL and 7.1 ± 1.4 mg/dL, respectively ($p = 0.02$). Although the requirement for phototherapy was more frequent in the deferred group (14%) than in the immediate group (6%), this difference did not reach statistical significance ($p = 0.18$).

Evaluation of maternal outcomes showed no meaningful differences between groups. Postpartum hemoglobin decline was similar in both groups (1.2 ± 0.5 g/dL versus 1.3 ± 0.6 g/dL; $p = 0.54$), and the occurrence of postpartum hemorrhage did not differ significantly (6% compared with 8%; $p = 0.69$).

Table 1: Neonatal Hematological Outcomes According to Timing of Umbilical Cord Interruption

Parameter	Immediate Cord Interruption (n = 50)	Deferred Cord Interruption (n = 50)	*p* value
Hemoglobin at 24 hours (g/dL)	15.9 ± 1.3	17.8 ± 1.4	<0.001
Hemoglobin at 48 hours (g/dL)	15.4 ± 1.2	17.2 ± 1.5	<0.001
Neonatal anemia, n (%)	9 (18%)	2 (4%)	0.03

Table 2: Neonatal Bilirubin Levels and Phototherapy Requirement

Parameter	Immediate Cord Interruption (n = 50)	Deferred Cord Interruption (n = 50)	*p* value
Bilirubin at 24 hours (mg/dL)	5.2 ± 1.1	6.1 ± 1.2	0.01
Bilirubin at 48 hours (mg/dL)	7.1 ± 1.4	8.3 ± 1.6	0.02
Phototherapy required, n (%)	3 (6%)	7 (14%)	0.18

Table 3: Maternal Blood Loss Outcomes

Parameter	Immediate Cord Interruption (n = 50)	Deferred Cord Interruption (n = 50)	*p* value
Postpartum hemoglobin change(g/dL)	1.3 ± 0.6	1.2 ± 0.5	0.54
Postpartum hemorrhage, n (%)	4 (8%)	3 (6%)	0.69

DISCUSSION

In this cohort of term infants, delaying interruption of placental blood flow was associated with superior hematological parameters during the early neonatal period. Higher hemoglobin concentrations observed in the deferred interruption group indicate a measurable alteration in circulatory transition at birth[3,4,5,6,14], suggesting that brief continuation of placental blood flow contributes to enhanced neonatal blood volume during a critical adaptive window.

This hematological advantage was accompanied by modest increases in bilirubin levels, reflecting a predictable consequence of increased erythrocyte mass[9,10]. Although phototherapy was required more frequently among infants exposed to deferred cord interruption, this difference was not statistically significant and remained clinically manageable. These findings indicate that the physiological trade-off associated with deferred interruption does not translate into disproportionate neonatal risk when appropriate monitoring is in place.

Maternal outcomes were unaffected by the timing of cord interruption. Measures of postpartum hemoglobin change and hemorrhagic events were comparable between groups, supporting the safety of deferred interruption within standard obstetric practice[11,12]. Together, these results position deferred cord interruption as a low-risk modification with tangible neonatal benefit.

While limited by short-term follow-up and sample size, the study demonstrates that cord clamping timing is not a neutral procedural choice but a modifiable determinant of early neonatal physiology[15,16]. Incorporation of deferred interruption, alongside routine surveillance for jaundice, may represent a rational approach to optimizing perinatal care.

CONCLUSION

Extending the interval before umbilical cord separation was associated with improved neonatal hemoglobin status in the early postnatal period, without evidence of increased maternal bleeding. Although higher bilirubin concentrations were observed, these changes remained within ranges that could be effectively managed through routine neonatal care. These results indicate that the timing of umbilical cord separation can be adjusted to enhance neonatal physiological outcomes while maintaining maternal safety[1,2].

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