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Benefits of Delayed Cord Clamping for Improvement of Neonatal Outcome

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Abstract

Delayed Cord Clamping (DCC) is an evidence-based obstetric and neonatal intervention that involves postponing the clamping of the umbilical cord for a specific period after childbirth, typically between 30 seconds to 3 minutes. Research has consistently shown that DCC improves neonatal health outcomes by enhancing hematologic status, increasing iron reserves, and contributing to better physiological adaptation during the transitional period. This manuscript explores the physiological benefits, clinical implications, and best practices surrounding DCC. The randomized controlled trial conducted on 200 healthy term neonates at a tertiary care hospital demonstrated that DCC significantly improves hemoglobin concentration, hematocrit levels, and reduces the incidence of neonatal anemia and need for transfusions, without increasing the risk of jaundice or other complications. The review of supporting literature further reinforces the safety and efficacy of DCC. Based on these findings, DCC should be promoted as a standard neonatal practice in all birthing facilities, especially in resource-limited settings where neonatal anemia is prevalent.

Keywords: Delayed Cord Clamping, Neonatal Outcome, Anemia, Hemoglobin, Umbilical Cord, Immediate Cord Clamping, Newborn Care, Hematologic Status, APGAR Score, Neonatal Jaundice

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Introduction

The transition from intrauterine to extrauterine life is one of the most critical physiological adaptations a newborn undergoes. During this period, the method and timing of umbilical cord clamping play a crucial role in determining immediate and long-term neonatal outcomes. Traditionally, Immediate Cord Clamping (ICC) — clamping within the first 15–30 seconds after birth — was widely practiced under the assumption that it facilitates quicker neonatal assessment and reduces maternal hemorrhage risk. However, growing evidence suggests that delaying cord clamping can offer considerable advantages for neonates, including improved cardiovascular stability, higher blood volume, and enhanced hematologic indices.

Delayed Cord Clamping (DCC) allows continued placental transfusion for up to 2–3 minutes post-delivery, contributing to increased hemoglobin levels and iron stores, particularly essential in preventing neonatal anemia in the early months of life. The World Health Organization (WHO), American College of Obstetricians and Gynecologists (ACOG), and other major health organizations now recommend DCC as a standard of care for both term and preterm infants.

This study evaluates the effects of DCC on neonatal hematologic parameters and overall outcomes compared to ICC, and provides a literature-backed rationale for its universal adoption in clinical practice.

Objectives

1. To assess the impact of delayed cord clamping on neonatal hemoglobin levels and hematocrit.
2. To compare the incidence of anemia and need for blood transfusion between DCC and ICC groups.
3. To evaluate the effect of DCC on APGAR scores, respiratory adaptation, and neonatal jaundice.
4. To promote evidence-based recommendations for delayed cord clamping in clinical practice.

Methodology

A randomized controlled trial was conducted in a tertiary care hospital's labor ward involving 200 healthy term neonates (≥37 weeks gestation) born via normal vaginal delivery. After obtaining informed consent, participants were randomly assigned into two groups:

- Delayed Cord Clamping Group (DCC): Cord clamped 2 minutes post-birth
- Immediate Cord Clamping Group (ICC): Cord clamped within 15 seconds post-birth

Inclusion Criteria:

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- Singleton term pregnancy
- Vaginal delivery
- Absence of congenital anomalies

Exclusion Criteria:

- Instrumental or cesarean delivery
- Maternal hemorrhage or other complications
- Neonates requiring resuscitation

Data Collection Tools:

- Hemoglobin and hematocrit levels were measured at birth and again at 6 weeks.
- APGAR scores were assessed at 1 and 5 minutes.
- Bilirubin levels and the need for phototherapy or transfusion were also recorded.

Data Analysis:
SPSS software was used for statistical analysis. Independent t-tests and chi-square tests determined the significance between groups. A p-value < 0.05 was considered statistically significant.

Results

The study included 200 neonates equally divided between the DCC and ICC groups. The DCC group demonstrated significantly higher mean hemoglobin levels both at birth and at six weeks. Hematocrit levels were similarly elevated in the DCC group. Although bilirubin levels were slightly higher in the DCC group, they did not result in significantly increased phototherapy needs. APGAR scores showed no significant differences. Transfusion requirement was significantly lower in the DCC group.

These results reinforce the hematologic advantage of DCC without increasing neonatal morbidity such as hyperbilirubinemia. The observed differences are consistent with published studies from various global centers supporting DCC's safety and efficacy.

Demographic Characteristics

Variable	DCC Group (n=100)	ICC Group (n=100)
Mean gestational age (wks)	39.1 ± 1.2	38.9 ± 1.1
Mean birth weight (kg)	3.05 ± 0.4	3.01 ± 0.3
Male : Female ratio	52:48	50:50

Neonatal Hematologic Outcomes

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Outcome	DCC Group	ICC Group
Hemoglobin at birth (g/dL)	18.5 ± 2.0	16.9 ± 1.7
Hemoglobin at 6 weeks	13.8 ± 1.4	12.2 ± 1.2
Hematocrit (%)	58.1 ± 4.5	51.2 ± 3.8
Bilirubin (mg/dL)	8.2 ± 1.6	7.9 ± 1.4

APGAR Scores

Time Point	DCC Group	ICC Group	p-value
1 minute	7.5 ± 0.7	7.6 ± 0.8	0.65
5 minutes	8.9 ± 0.5	8.8 ± 0.6	0.34

Discussion

This study demonstrates that delayed cord clamping significantly improves hematologic parameters such as hemoglobin and hematocrit levels at birth and at six weeks postpartum. These findings align with studies by Chartrand et al. (2024) and Ofojebe et al. (2021), who reported improved hemoglobin levels and reduced need for transfusions in the DCC group.

Although there was a slight increase in bilirubin levels in the DCC group, this difference was not statistically significant and did not result in increased need for phototherapy, corroborating findings from Herold et al. (2024).

The APGAR scores and early neonatal adaptation did not differ significantly between the groups, suggesting that DCC does not delay neonatal stabilization. Moreover, DCC had a protective effect against neonatal anemia, as evidenced by the significantly lower transfusion rate.

Physiological Basis for Benefits:
The placenta retains about one-third of the fetal-placental blood volume at birth. Allowing time for placental transfusion ensures optimal blood volume, which is critical for:

- Enhanced oxygen transport
- Improved thermoregulation
- Better perfusion to vital organs

DCC is also cost-effective, especially important in low- and middle-income countries, where the burden of neonatal anemia is high and access to blood transfusion may be limited.

Review of Related Literature

Numerous studies worldwide have investigated the effects of delayed cord clamping:

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- Knol et al. (2020): PBCC (physiologic-based cord clamping) in preterm infants demonstrated safety and efficacy comparable to DCC.
- Chartrand et al. (2024): DCC in twin preterm neonates significantly reduced in-hospital mortality and need for red blood cell transfusion.
- Enyinna et al. (2024): DCC group had significantly higher hemoglobin at 48 hours than the ICC group.
- Bruckner et al. (2021): DCC in term neonates resulted in better neurodevelopmental outcomes up to 4 years.
- Robledo et al. (2022): DCC reduced mortality and major disability in preterm infants by 17% at 2 years.
- Padilla-Sánchez et al. (2024): Higher oxygen saturation and heart rate in first 5 minutes after birth in infants with DCC ≥60 seconds.

These findings consistently highlight long-term benefits, particularly in terms of neurodevelopment, iron reserves, and survival.

Conclusion

Delayed cord clamping is a simple, safe, and evidence-based intervention that can significantly enhance neonatal outcomes. The findings from this study and supporting literature strongly advocate for the universal implementation of DCC, particularly in settings where neonatal anemia and limited access to transfusion services pose serious risks.

Recommendations

1. Policy Implementation: Institutions should adopt DCC as standard practice in obstetric protocols.
2. Training and Awareness: Regular workshops for midwives, nurses, and obstetricians on the technique and timing of DCC.
3. Parental Education: Informing expectant parents about the benefits of DCC during antenatal visits.
4. Further Research: More studies on DCC in special populations such as preterm twins, IUGR, and cesarean deliveries.

Conflict of Interest: The authors declare no conflict of interest.

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