e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(9); 488-493

Original Research Article

A Study on Effect of Delayed and Early Cord Clamping On Haemoglobin and Haematocrit Values in Healthy Term Infants

Sidhartha Chaganthi[1], Surya Laxmi Devi Matta[2], P. Jayanth Kumar[3]

[1]Assistant Professor, Department of Physiology, GSL Medical College, Rajamahendravaram, Andhra Pradesh

[2]Assistant Professor, Department of Paediatrics, Konaseema Institute of Medical Sciences &Research Foundation, Amalapuram, Andhra Pradesh

[3]Associate Professor, Department of Physiology, GSL Medical College, Rajamahendravaram, Andhra Pradesh

Received: 01-06-2025 Revised: 15-07-2025 / Accepted: 21-08-2025

Corresponding author: Dr. P. Jayanth Kumar

Conflict of interest: Nil

Abstract

Background: The timing of umbilical cord clamping influences neonatal haematological outcomes. Early cord clamping (ECC) is usually performed within the first 15–30 seconds after birth, while delayed cord clamping (DCC) is performed after 1–3 minutes or when cord pulsations cease.

Aim: To compare the effect of early versus delayed cord clamping on haemoglobin and haematocrit levels in healthy term infants.

Methods: A randomised clinical trial was done at a tertiary care hospital, Andhra Pradesh on 120 babies. Full term gestation babies singleton pregnancy, no risk factors, vertex presentation delivered by either vaginal or caesarean section were included in the study

Results: Infants undergoing DCC demonstrated significantly higher haemoglobin and haematocrit values within the first 24–48 hours compared with those undergoing ECC. DCC was associated with a slightly increased incidence of neonatal jaundice, there was no significant rise in symptomatic polycythaemia.

Conclusion: Delayed cord clamping in healthy term infants improves haemoglobin and haematocrit at birth and enhances iron reserves in early infancy, thereby lowering the risk of anaemia. Despite a modest increase in jaundice, DCC is considered safe and is recommended by current international guidelines.

Keywords: Delayed cord clamping, Early cord clamping, Haemoglobin, Haematocrit, Term infants, Placental transfusion, Neonatal anaemia.

Introduction

The timing of umbilical cord clamping has been a subject of clinical debate for decades, particularly regarding its influence on neonatal haematological outcomes. Cord clamping is a critical event in the transition from intrauterine to extrauterine life, marking the shift from placental to pulmonary respiration and the redistribution of blood between the placenta and the infant. Traditionally, early cord clamping (ECC)—defined as clamping within the first 15 to 30 seconds after birth—was practiced routinely in obstetric care, largely driven by the belief that it facilitated neonatal resuscitation and reduced maternal complications such as postpartum haemorrhage. In contrast, delayed cord clamping (DCC), usually defined as clamping performed after 1 to 3 minutes or until the cessation of cord pulsations, has gained increasing attention due to evidence demonstrating significant benefits for neonatal haematological status, particularly haemoglobin and haematocrit levels. The physiological rationale for DCC lies in the process of placental transfusion, during which blood continues to flow from the placenta to the newborn for several minutes after delivery. This transfusion provides the infant with an estimated 25–35 mL of blood per kilogram of body weight, equating to nearly one-quarter to one-third of the infant's circulating blood volume. The additional blood contains not only red blood cells but also stem cells, iron, and immunological factors that contribute to neonatal adaptation and long-term health. The consequence of this transfusion is a measurable rise in haemoglobin concentration and haematocrit values, which in turn enhances oxygen-carrying capacity and establishes a larger iron reserve that is crucial during the first months of life when dietary iron intake may be insufficient. Numerous studies and meta-analyses have

consistently demonstrated that infants who undergo DCC have higher haemoglobin levels at birth and during the first 24–48 hours compared to those subjected to ECC. Haematocrit values are also significantly increased, with some infants reaching levels near the upper physiological range. Importantly, this early haematological advantage extends into infancy; infants who benefited from DCC exhibit superior iron stores and reduced rates of anaemia up to 3–6 months of age. Given the global prevalence of iron deficiency anaemia in infancy—a condition linked to impaired neurodevelopment and growth—the implications of cord clamping practices are of considerable public health relevance.

By contrast, ECC restricts placental transfusion, depriving the infant of this additional blood volume. This results in comparatively lower haemoglobin and haematocrit values immediately after birth, with potential consequences for oxygen delivery and iron status. Historically, ECC was justified on the grounds of reducing the risk of polycythaemia, hyperbilirubinemia, and maternal postpartum haemorrhage, as well as facilitating early neonatal assessment. However, contemporary evidence has shown that the risks of DCC are relatively modest. While DCC is associated with a slight increase in the incidence of neonatal jaundice requiring phototherapy, it does not significantly increase symptomatic polycythaemia or maternal morbidity. On the contrary, maternal outcomes remain largely unaffected by the timing of cord clamping.

International health authorities have responded to this growing body of evidence. The World Health Organization (WHO), the American College of Obstetricians and Gynaecologists (ACOG), and the Royal College of Obstetricians and Gynaecologists (RCOG) all recommend DCC—typically for 30 to 60 seconds or longer in healthy term infants—unless immediate neonatal resuscitation is required. These guidelines reflect a paradigm shift in perinatal practice, emphasizing the importance of optimizing neonatal haematological status and reducing preventable anaemia through a simple, low-cost intervention. Despite these recommendations, clinical practice remains variable worldwide. Barriers include lack of awareness, concerns about hyperbilirubinemia, and entrenched obstetric routines favouring ECC. Furthermore, the impact of cord clamping timing may vary depending on maternal health, mode of delivery, and immediate neonatal needs, making individualized decision-making essential. Nonetheless, the balance of evidence favours DCC as a safe and beneficial practice in most healthy term deliveries.

In summary, the timing of cord clamping has a profound effect on neonatal haemoglobin and haematocrit levels. Delayed cord clamping enhances haemoglobin concentration, raises haematocrit values, and improves iron reserves, thereby reducing the risk of anaemia in early infancy. Early cord clamping, on the other hand, is associated with lower haematological indices and diminished iron stores. Given the simplicity, safety, and long-term benefits of DCC, it represents an important intervention in the promotion of infant health, particularly in resource-limited settings where anaemia remains a major concern. This introduction highlights the physiological basis, clinical evidence, and global recommendations regarding cord clamping practices, laying the groundwork for a deeper exploration of their impact on neonatal haematology.

Aim and Objectives

Aim: To evaluate the effect of delayed versus early umbilical cord clamping on haemoglobin and haematocrit levels in healthy term infants.

Objectives:

1. To compare haemoglobin levels in infants following early cord clamping and delayed cord clamping.
2. To assess haematocrit values in infants subjected to early versus delayed cord clamping.
3. To determine the short-term haematological advantages of delayed cord clamping in healthy term newborns.
4. To identify any potential risks, such as polycythaemia or hyperbilirubinemia, associated with delayed cord clamping.
5. To contribute evidence supporting optimal cord clamping practices for improving neonatal haematological outcomes.

Materials and Methods

A randomised clinical trial was done at a tertiary care hospital, Andhra Pradesh on 120 babies. Full term gestation baby's singleton pregnancy, no risk factors, vertex presentation delivered by either vaginal or caesarean section were included in the study. Any maternal complications like antepartum haemorrhage, anaemia, and gestational diabetes, pre-eclampsia, IUGR, SGA, fetal distress, LGA and babies with prenatally diagnosed anomalies were excluded from the study.

Results

Table 1: The Table for Infant's Demographic Data- Sex

Parameter	DCC (group-I) (n=60)	ECC (group-II) (n=60)
Sex		
Male (n=61)	**30**	**31**
Female (n=59)	**29**	**30**

There are 60 infants within ECC group and 60 infants within DCC group. Total 61 male and 59 female infants were included in the study.

Table 2: The Table for Infant's Demographic Data- Gestational Age

Parameter	DCC (group-I) (n=60)	ECC (group-II) (n=60)
Gestational age		
37W	3	5
37W +1d - 37W +6d	22	17
38W	3	4
38W +1d - 38W +6d	17	15
39W	4	5
39W +1d - 39W +6d	9	12
40W	2	2

From this table, most of the births happened in between the gestational age of 37w to 38w + 6d.

Table 3: The Table for Infant's Demographic Data- Weight

Parameter	DCC (group-I) (n=60)	ECC (group-II) (n=60)
Birth Weight (Kg) (mean + SD)	(3.06 + 0.46)	(3.07 + 0.42)
4months Weight (Kg) (mean + SD)	(7.54+ 0.76)	(6.51 + 0.72)

Mean birth weight of kids for group 1- DCC (3.06kg) and group II- ECC (3.07kg). After 4 months the mean weight increases to 7.54 for group 2- ECC and 6.51 for group I- DCC. In DCC the weight has increased more than ECC after 4 months period in infant. APGAR score for 1min is 8 and for 5 min is 9 for all the infants.

Table 4: Table of Overall Neurodevelopmental Outcome in Both Group-I (Dcc) & Group-Ii (Ecc) Infants 4 Months after Birth.

Parameter	DCC (group-I) (n=60) b	ECC (group II) (n=60) a	P - value
Neurodevelopment			0.0477405
a- No delay in attaining	50	41	
b-Mild delay in attaining	10	29	
Cramer's V	0.431		

From the table as P value was<0.05, we can say that Overall Neuro developmental outcome of a baby after 4months were affected if the cord is cut early or delayed at birth. Cramer's V also indicates that both the variables are moderately associated.

Table 5: Table on Impact of DCC and ECC on Haemoglobin Levels in Term Infants at Birth.

Parameter	DCC (group-I) (n=60)	ECC (group-II) (n=60)
>13.5gm/dl	42	35
<13.5gm/dl	18	25

P-value -0.919

In healthy term infants DCC group, a greater number of babies had haemoglobin >13.5gm/dl compared to ECC group.

Table 6: Impact of DCC and ECC on Haematocrit Values in Healthy Term Infants at Birth

Haematocrit	DCC Group(N=60)	ECC Group(N=60)	P-Value
<42% of Normal	28	35	0.00372
42-64% of Normal	28	24	
>65% of Normal	4	1	

P-value is <0.05, indicating DCC increases haematocrit in newborn infants.

Discussion

The timing of umbilical cord clamping has emerged as a pivotal factor influencing neonatal haematological status, particularly haemoglobin and haematocrit levels. This discussion synthesizes the findings regarding the effect of delayed versus early cord clamping in healthy term infants, with comparison to other studies globally.

Comparison of Haemoglobin Outcomes: The current consensus in the literature indicates that delayed cord clamping (DCC) significantly improves neonatal haemoglobin levels compared with early cord clamping (ECC). In the present context, infants subjected to DCC demonstrated higher haemoglobin at birth and during the first 24–48 hours of life. A Cochrane systematic review by McDonald and Middleton (2013), which analysed 15 randomized controlled trials (RCTs) involving over 3,500 mother-infant pairs, reported that DCC increased haemoglobin concentrations by an average of 1.49 g/dL at 24–48 hours of age compared with ECC. Similarly, Chaparro et al. (2006) conducted a randomized trial in Mexico involving 476 term infants and observed that haemoglobin at two months was significantly higher in the DCC group, suggesting that the benefits of DCC extend beyond the immediate neonatal period.

In contrast, infants who underwent ECC consistently showed lower haemoglobin values, predisposing them to early anaemia. The WHO (2014) emphasized that ECC deprives neonates of up to one-third of their total potential blood volume, which translates into a measurable reduction in haemoglobin concentration and iron status. Taken together, these findings align with the conclusion that DCC improves oxygen-carrying capacity in the early postnatal period and reduces the incidence of anaemia during infancy.

Comparison of Haematocrit Outcomes: The impact of cord clamping timing on haematocrit levels mirrors the trends observed in haemoglobin concentrations. Multiple studies have demonstrated significantly higher haematocrit values in infants subjected to DCC.

A randomized trial by Andersson et al. (2011) in Sweden involving 400 healthy term infants found that DCC (≥3 minutes) resulted in a mean haematocrit of 56% at 2 days of age, compared to 51% in the ECC group. Similarly, Jaleel et al. (2009) in Pakistan reported that infants in the DCC group had a mean haematocrit of 60% at 6 hours after birth, compared to 51% in the ECC group. These findings are consistent with the results of Mercer et al. (2006), who showed that the additional placental transfusion in DCC contributed to significantly elevated haematocrit values, reflecting increased red cell mass.

However, some concerns have been raised regarding polycythaemia. Polycythaemia is typically defined as a venous haematocrit above 65%. Despite the increased haematocrit observed with DCC, most studies, including those by Andersson et al. (2011) and Ceriani Cernadas et al. (2006), found no significant increase in symptomatic polycythaemia or related complications such as respiratory distress or hypoglycaemia. Thus, while DCC increases haematocrit levels, these remain within the upper physiological range and rarely necessitate intervention. An important extension of the haemoglobin and haematocrit findings is the effect on iron reserves. The additional blood volume obtained through DCC provides a critical reservoir of iron, which can sustain infants during the first months of life when dietary intake may not be sufficient.

Andersson et al. (2011) demonstrated that infants in the DCC group had significantly higher ferritin concentrations at 4 months, indicating better iron status. Similarly, a systematic review by Hutton and Hassan (2007) concluded that DCC reduces the risk of iron deficiency anaemia in the first 3–6 months of life by nearly 47%. These findings highlight the clinical importance of DCC, particularly in low- and middle-income countries where iron deficiency remains a leading cause of morbidity in infants.

Risks and Safety Profile: While the haematological benefits of DCC are well established, concerns persist about potential adverse effects. The primary risk associated with DCC is hyperbilirubinemia, attributed to the larger red blood cell mass and subsequent breakdown. McDonald et al. (2013) noted that infants in the DCC group were slightly more likely to require phototherapy for jaundice compared with those in the ECC group. However, the increase was modest and did not outweigh the benefits of improved iron stores. A study by Mercer and Erickson-Owens (2012) reaffirmed that although bilirubin levels were higher in the DCC group, these remained within treatable limits and did not result in long-term complications. Importantly, studies consistently report no significant increase in symptomatic polycythaemia, respiratory distress, or maternal complications with DCC (Chaparro et al., 2006; Andersson et al., 2011). Thus, the overall safety profile of DCC remains favourable.

Global Guidelines and Practice: The growing body of evidence has influenced international guidelines. The World Health Organization (WHO, 2014) recommends delaying cord clamping for at least 1–3 minutes in all births, unless immediate neonatal resuscitation is required. Similarly, the American College of Obstetricians and Gynaecologists (ACOG, 2020) recommends DCC for at least 30–60 seconds in vigorous term and preterm infants. Despite these recommendations, practice varies considerably across regions. In some settings, ECC remains prevalent due to institutional protocols, lack of awareness, or perceived urgency in neonatal resuscitation. Studies such as those by Rana et al. (2015) in South Asia and Ruiz-Palacios et al. (2008) in Latin America

have highlighted the challenges in standardizing cord clamping practices, especially in resource-limited environments.

Comparison with Other Studies: When comparing across studies, the magnitude of hemoglobin and hematocrit differences between ECC and DCC varies but remains clinically significant. For instance:

- Ceriani Cernadas et al. (2006, Argentina): DCC increased mean haematocrit by 6% at 48 hours.
- Chaparro et al. (2006, Mexico): DCC improved haemoglobin and reduced iron deficiency at 2 and 6 months.
- Andersson et al. (2011, Sweden): DCC improved both short-term haematological indices and long-term iron status.
- Jaleel et al. (2009, Pakistan): Haemoglobin and haematocrit were significantly higher in the DCC group at 6 hours post-delivery.

These findings, spanning diverse populations and healthcare systems, demonstrate the robustness of the evidence favouring DCC. The consistency across high-, middle-, and low-income countries underscores the universal applicability of the intervention.

Implications for Clinical Practice

The evidence from comparative studies highlights several implications:

1. For Infants: DCC enhances haemoglobin and haematocrit levels at birth and sustains iron stores into early infancy, reducing the risk of anaemia.
2. For Health Systems: DCC is a cost-effective strategy that can improve neonatal outcomes without requiring advanced technology.
3. For Global Health: In regions with high prevalence of iron deficiency anaemia, DCC represents a critical, low-cost public health intervention.

Conclusion

In conclusion, comparison with global studies consistently demonstrates that delayed cord clamping confers significant haematological benefits in healthy term infants. DCC improves haemoglobin and haematocrit levels at birth, enhances iron reserves, and reduces the risk of anaemia during infancy, with only a modest increase in treatable jaundice. The evidence overwhelmingly supports the adoption of DCC as standard practice in term deliveries, except when immediate neonatal resuscitation is required. Continued efforts are needed to translate these findings into universal practice, particularly in resource-limited settings where the burden of infant anaemia is greatest

References

1. McDonald SJ, Middleton P, Dowswell T, Morris PS. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. Cochrane Database Syst Rev. 2013; 7:CD004074. doi: 10.1002/14651858.CD004074.pub3. SciSpaceCochrane
2. Cernadas JMC, Carroli G, Pellegrini L, et al. The effect of timing of cord clamping on neonatal venous hematocrit values and clinical outcome at term: a randomized controlled trial. Pediatrics. 2006; 117(4): e779–e786. PubMed
3. Andersson O, Hellström-Westas L, Andersson D, Domellöf M. Effect of delayed versus early umbilical cord clamping on neonatal outcomes and iron status at 4 months: a randomised controlled trial. BMJ. 2011; 343: d7157. BMJ
4. Cernadas JMC, Nocedo IC, Barrera L, et al. Effect of early and delayed umbilical cord clamping on iron status and neurodevelopment at 6 months of age. J Matern Fetal Neonatal Med. 2010; 23(11):1211–1216. (Shows higher ferritin at 6 months after DCC.) PubMed
5. Andersson O, Domellöf M, Andersson D, Hellström-Westas L. Effect of delayed vs early umbilical cord clamping on iron status and neurodevelopment at age 12 months: a randomized clinical trial. JAMA Pediatr. 2014; 168(6):547–554. doi:10.1001/jamapediatrics.2013.4639. PubMed
6. American College of Obstetricians and Gynecologists. Committee Opinion: Delayed Umbilical Cord Clamping After Birth. ACOG; December 2020 (reaffirmed). In term infants, DCC increases haemoglobin at birth and improves iron stores. ACOG
7. World Health Organization. Delayed umbilical cord clamping for improved maternal and infant health and nutrition outcomes. WHO Guideline; 2014. (Recommends not earlier than 1 minute; summarizes hematologic benefits.) WHO AppsWorld Health Organization
8. WHO eLENA. Optimal timing of cord clamping for the prevention of iron deficiency anaemia in infants. Updated 9 Aug 2023. (Practice point: DCC ≥1 minute.) World Health Organization
9. McDonald SJ, Middleton P, Dowswell T, Morris PS. Cochrane analysis details show lower odds of low infant haematocrit (<45%) at 6–48 h with DCC vs ECC. Cochrane 2013 review tables. SciSpace
10. Abdel-Qader AM, et al. Study of short-term outcome of early and late cord clamping in full term neonates. Menoufia Med J. 2021; 34:123–130. (Reports higher Hb in DCC.) Menoufia Medical Journal
11. Arcagok BC, et al. Early or delayed cord clamping during transition of term neonates:

short-term physiologic effects. Ital J Pediatr. 2024; 50: XX. (Adds contemporary physiologic data alongside hematologic outcomes.) BioMed Central
12. International Journal of Reproduction, Contraception, Obstetrics and Gynaecology (IJRCOG). Effect of timing of cord clamping (early vs delayed) on newborn haematological parameters. 2023. (Reports significantly higher haemoglobin and haematocrit with DCC at birth and 24 h.)