



# DELAYED CORD CLAMPING VERSUS UMBILICAL CORD MILKING IN TERM AND NEAR-TERM NEONATES - A RANDOMIZED CONTROLLED TRIAL



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## Abstract

**Objective:** To compare the effect of delayed cord clamping(DCC) versus milking of umbilical cord (UCM) on initial hematocrit in term and near-term neonates.

**Methods:** This randomized controlled trial included 374 pregnant women of more than 34 weeks period of gestation. They were randomized into UCM group and DCC group. In UCM group, 119 underwent vaginal delivery and 68 underwent caesarean section. In DCC group, 117 underwent vaginal delivery and 70 underwent caesarean section.

**Results:** Mean hematocrit in cord sample was 47.02±7.13% in UCM group and 48.04±8.36% in DCC group and the difference was not statistically significant (p=0.21). Mean hematocrit at 30±6 hours was 54.48±5.84% in UCM group and 50.9±7.1 in DCC group and the difference was statistically significant(p=0.01). Requirement of phototherapy in UCM group was 18.18% and in DCC group was 19.25%(p=0.79). Rate of NICU admission was 2.67% in UCM group and 7.49% in DCC group(p=0.034).

**Conclusion:** UCM lead to significant increase in hematocrit levels without increasing the requirement of phototherapy and NICU admissions. Hence, UCM can be used as an alternative to DCC in both term and near-term neonates.

## Introduction

According to National Family Health Survey 2019-21, incidence of anemia in 6 months to 5 years children in India is 67%. Earlier, Immediate cord clamping (ICC) was recommended, but now the concept of placental transfusion has come into practice. Different strategies include delayed cord clamping (DCC), milking of intact umbilical cord and milking of the cut umbilical cord.

In DCC, the cord is clamped 60 seconds after birth, and in Umbilical cord milking (UCM), umbilical cord (UC) blood is milked from the placental end towards the baby (three to four times). The main difference between DCC and UCM is in the mechanism of cord blood transfer to the newborn. In DCC, there is a passive transfer of blood that occurs at a slow rate, whereas in UCM, there is an active transfer of blood that occurs at a rapid rate. These strategies, prevent anemia in infants by allowing transfer of additional blood volume to the newborn.

The reduction of iron deficiency anaemia can have a significant impact on children's health and long-term neurodevelopment not only for developing countries but also for high-income countries.

Important concern related to DCC is that it might become a barrier to resuscitation in non-vigorous babies at birth and may lead to Intraventricular hemorrhage (IVH) or death of the newborn.

UCM has shown to have similar effects on neonatal outcomes as DCC in both term and preterm infants. Furthermore, UCM can be performed within current resuscitation timeline recommendations before clamping the UC, and thus may be more beneficial than DCC. Despite numerous studies on UCM, there is limited literature available on comparison of DCC vs UCM in term neonates.

The aim of our study is to investigate the effect of UCM compared with DCC on initial hematocrit among term and near-term neonates (more than 34 weeks period of gestation) in both vaginal as well as cesarean delivery.

## Methods and Materials

This Randomized controlled trial was conducted from 20 February 2020 to 30 September 2021 in a tertiary care teaching institute of India.

**Participants:** We included all singleton neonates born at 34 completed weeks or more, delivered either by cesarean section or by vaginal delivery after obtaining written informed consent. Exclusion criteria included neonates with short UC(<25cm), limp and non-vigorous babies, delivery to Rh-negative mothers, instrumental deliveries, twin and higher order gestation, delivery by cesarean section for fetal compromise, congenital anomalies, fetal hydrops, cord prolapse, placenta previa, placental abruption, cord abnormalities such as true knots and fetal growth restriction.

**Intervention:** In UCM group, manual milking or stripping of approximately 20cm of UC from the placental end to the infant's umbilicus 4 times by holding the UC in between the thumb and the fingers at the speed of 10cm/sec was done. Around 1-2 seconds was allowed for refill of the UC in between each milking maneuver. After milking the UC four times, early cord clamping (ECC) was done, and the UC was cut. This whole process of UCM took nearly 20-25 seconds from the delivery of the baby. After cutting the UC, the baby was kept under the radiant warmer.

In DCC group, the UC was clamped after a time lapse of at least 60 seconds or till the cord pulsations ceased. Then the UC was cut, and the baby received routine care similar to the UCM group. The time to clamping and milking the UC was measured by wall mounted quartz clocks.

After the UC was cut, around 2 ml of cord blood was obtained in EDTA vial and sent for the evaluation of the hematocrit. Another sample for hematocrit was obtained at 30±6 hours of life by the neonatologist. The newborn was evaluated for the development of jaundice and the need for phototherapy.

**Outcomes:** The primary outcome of our study was to compare initial hematocrit of cord sample and at 30±6 hours in term and near-term neonates in two groups. Secondary outcomes included requirement of phototherapy, NICU admission and incidence of polycythemia in neonates.

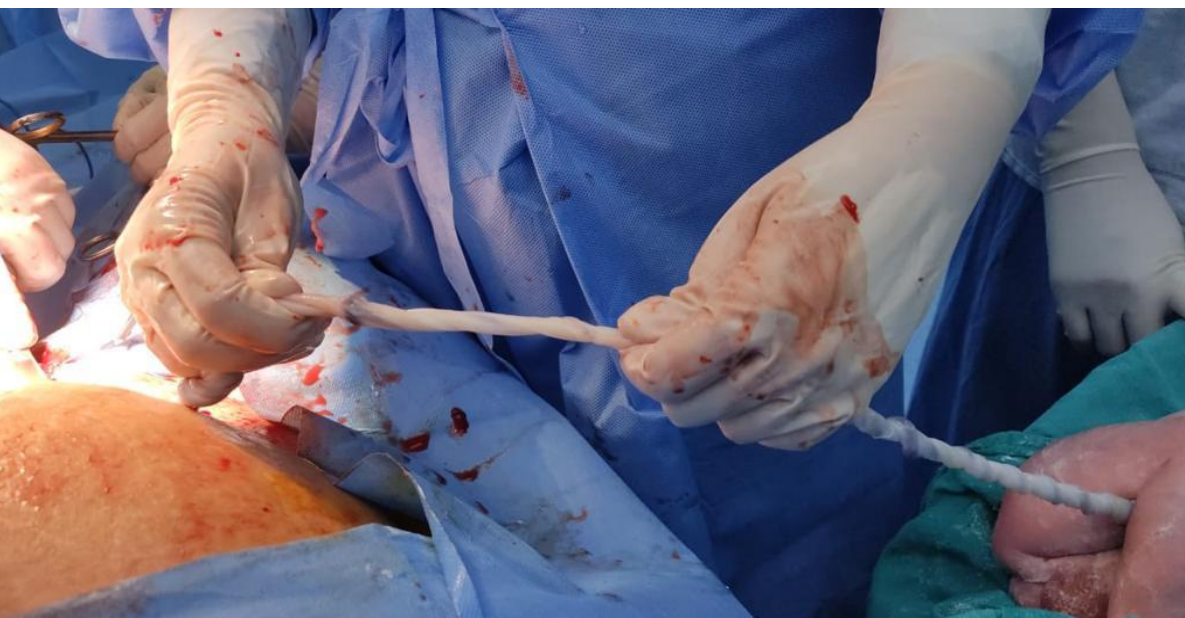


Figure 1. Umbilical Cord Milking.

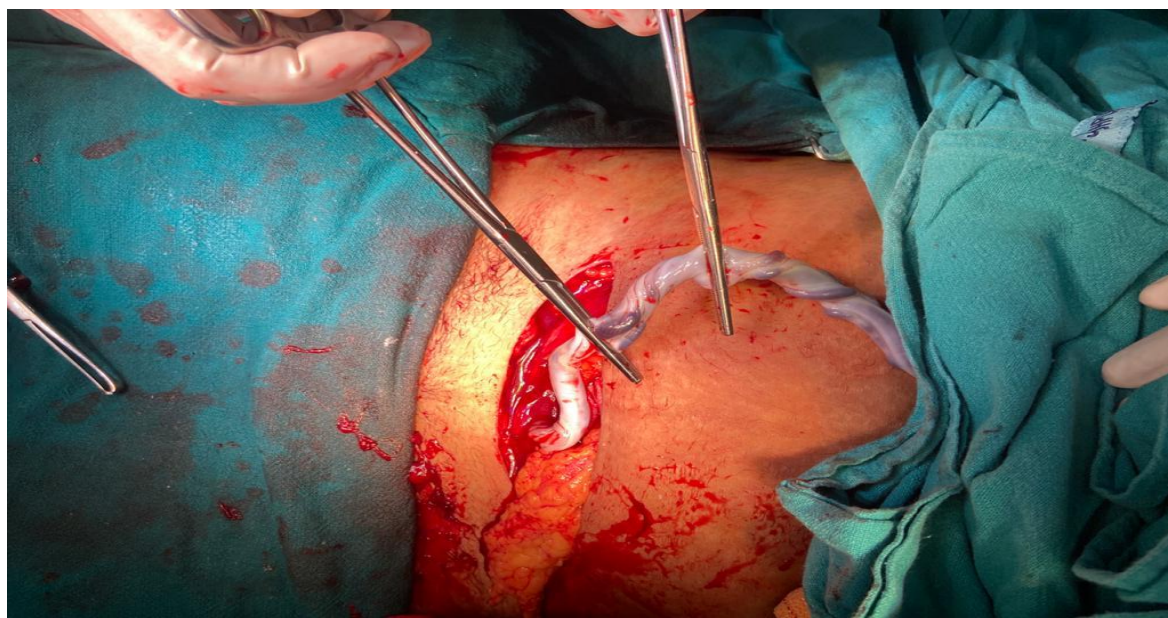


Figure 2. Delayed Cord Clamping.

**Statistical Analysis:** All the analysis was performed by using Statistical package for social sciences (SPSS) software 21. Bell shaped curve and One-sample Kolmogorov- Smirnov test was used to check normal distribution of continuous data. Student *t* test was used to analyze normally distributed and Mann Whitney U test was used for non-normally distributed data. For categorical variables, chi-square test was used at a two-sided significant level of 0.05 for testing the differences between two groups.

## Results

Table 1. Study Outcomes.

|                             | UCM group (n=187) | DCC group (n=187) | P value |
|-----------------------------|-------------------|-------------------|---------|
| Hematocrit in cord sample   | 47.0 ± 7.1        | 48.0 ± 8.3        | 0.21    |
| Hematocrit at 30±6 hours    | 54.4 ± 5.8        | 50.9 ± 7.1        | <0.01   |
| Phototherapy                | 34 (18.18%)       | 36 (19.25%)       | 0.79    |
| NICU admissions             | 5 (2.67%)         | 14 (7.49%)        | 0.03    |
| Polycythemia in cord sample | 2 (1.07%)         | 5 (2.67%)         | 0.25    |
| Polycythemia at 30±6 hours  | 4 (2.14%)         | 3 (1.6%)          | 0.70    |

Chart 1. Comparison of Hematocrit.

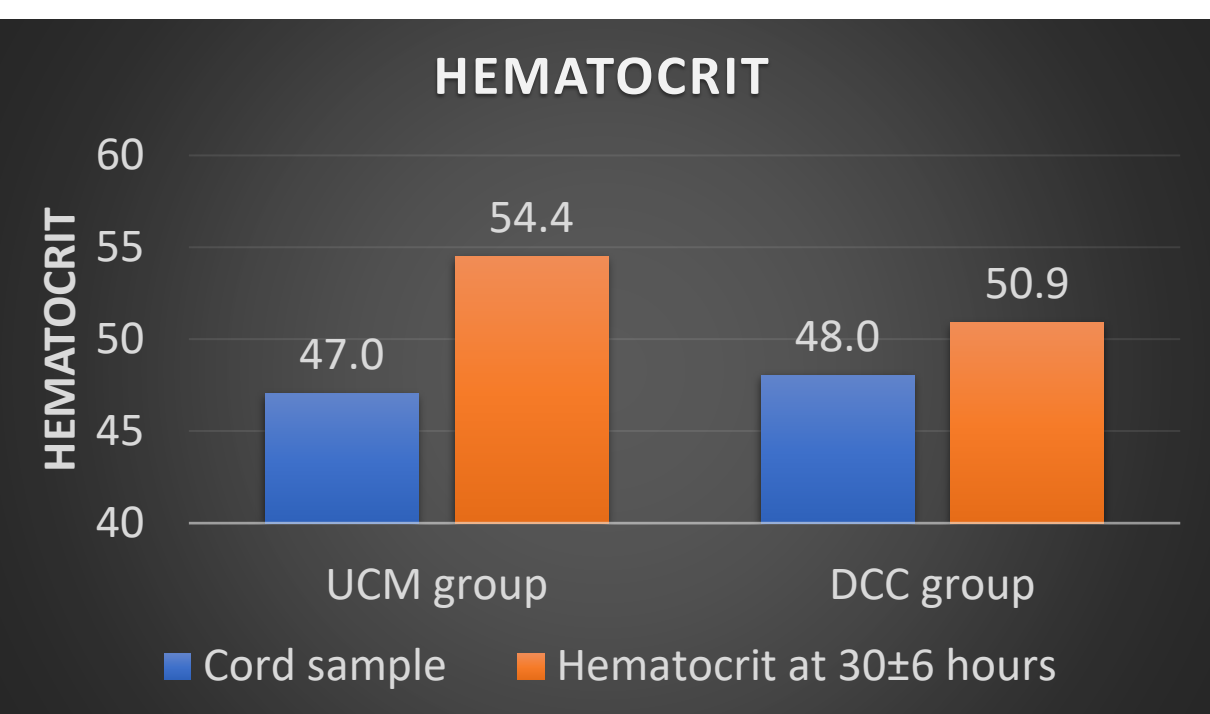
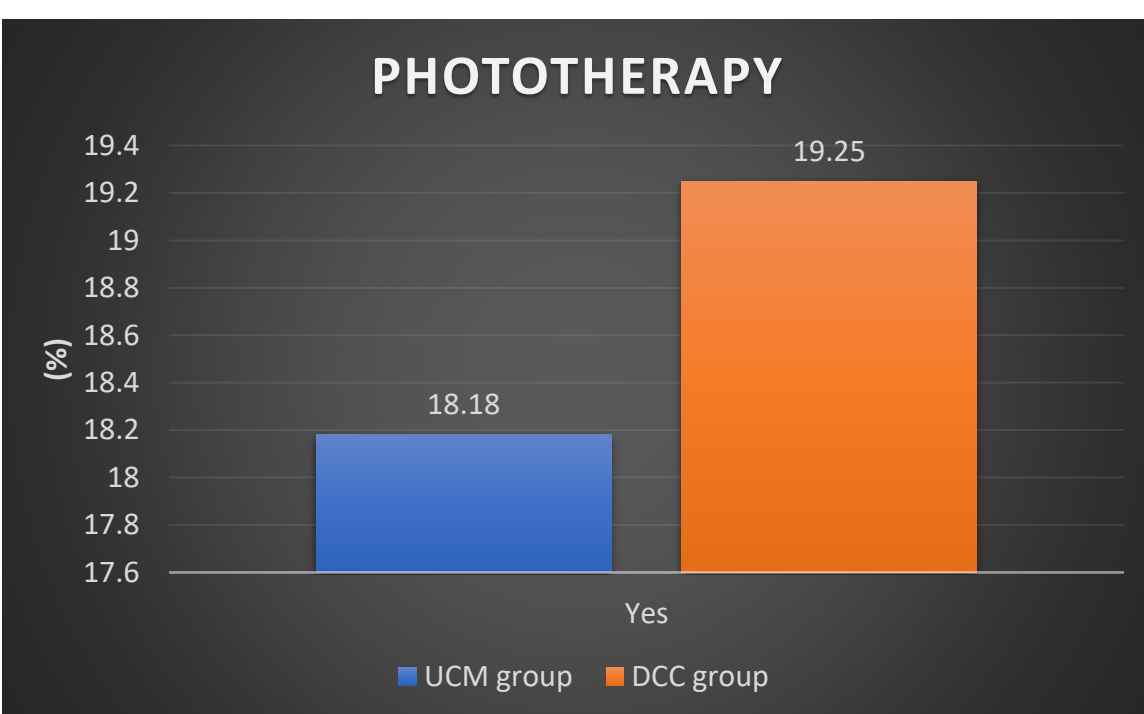


Chart 2. Requirement of Phototherapy.



In newborn born to anemic mothers, mean hematocrit in cord sample was 45.9±6.4% in UCM group and 48.8±8.4% in DCC group which was statistically significant (p=0.02). However, mean hematocrit at 30±6 hours was not statistically significant (p=0.11) in newborn born to anemic mothers.

In newborn born to non-anemic mothers, mean hematocrit in cord sample was not statistically significant (p=0.98). However, mean hematocrit at 30±6 hours was 55.0±5.5% in UCM group and 50.5±7.4% in DCC group which was statistically significant (p=0.0001).

In Preterm neonates, mean hematocrit in cord sample as well as at 30±6 hours was not statistically significant.

In Term neonates, mean hematocrit in cord sample was not statistically significant (p=0.23). However, mean hematocrit at 30±6 hours was 54.5±5.7% in UCM group and 50.8±7.1% in DCC group which was statistically significant (p=0.0001). In

Appropriate for gestational age(AGA) neonates, mean hematocrit in cord sample was not statistically significant (p=0.25). However, mean hematocrit at 30±6 hours was 53.8±5.6% in UCM group and 50.3±6.9% in DCC group which was statistically significant (p=0.0001).

In Small for gestational age(SGA) neonates, mean hematocrit in cord sample as well as at 30±6 hours was not statistically significant.

## Discussion

Table 2. Comparison of Mean Hematocrit at Birth.

|                                                   | Mean hematocrit at birth in UCM group | Mean hematocrit at birth in DCC group | P value |
|---------------------------------------------------|---------------------------------------|---------------------------------------|---------|
| Rabe et al (2011) <sup>[1]</sup>                  | 52.0 ± 8.0                            | 51.0 ± 7.0%                           | 0.65    |
| Jaiswal et al (2015) <sup>[2]</sup>               | 50.9 ± 6.4%                           | 50.3 ± 6.8%                           | 0.46    |
| Samantha et al (2019) <sup>[3]</sup>              | 51.8 ± 6.2%                           | 49.9 ± 7.7%                           | 0.07    |
| Katheria et al <sup>#</sup> (2015) <sup>[4]</sup> | 16.3 ± 2.4g%                          | 15.6 ± 2.2g%                          | <0.05   |
| Index study                                       | 47.0 ± 7.1%                           | 48.0 ± 8.3%                           | 0.21    |

<sup>#</sup>Mean Hemoglobin

Table 2. Comparison of Mean Hematocrit beyond 24 Hours.

|                                                    | Mean hematocrit beyond 24 hours in UCM group | Mean hematocrit beyond 24 hours in DCC group | P value |
|----------------------------------------------------|----------------------------------------------|----------------------------------------------|---------|
| Jaiswal et al (2015) <sup>[2]</sup> (At 48 hours)  | 48.5 ± 6.8%                                  | 48.0 ± 6.8%                                  | 0.60    |
| Mangla et al (2020) <sup>[5]</sup> (At 48±6 hours) | 57.7 ± 4.3%                                  | 55.9 ± 4.4%                                  | 0.02    |
| Index study (At 30±6 hours)                        | 54.4 ± 5.8%                                  | 50.9 ± 7.1%                                  | <0.01   |

Main strength of our study was that it was a randomized controlled trial conducted in both term and near-term neonates and it was stratified into vaginal delivery and caesarean section which was not done by any other study. Another strength of our study was large sample size of 374. Large sample size provides more accurate mean values and hence the data is more reliable. Also, we did intact-UCM four times which allowed refilling of the cord from the placenta in between each milking maneuver. We did subgroup analysis in anemic and non-anemic mothers; in term and preterm neonates and in AGA and SGA neonates which was not done by any other study published so far.

Our study had few limitations too. Long term follow up was not done in our study which is desired to establish whether initial increase in hematocrit sustains later in infancy and early childhood. Also, this study was not powered to assess the side effects of each method conclusively.

## Conclusions

It can be concluded from our study that UCM lead to significant increase in hematocrit levels at 30±6 hours without increasing the side effects like jaundice requiring phototherapy, polycythemia and NICU admissions in term and near-term neonates. UCM lead to significant increase in hematocrit in AGA neonates as compared to DCC. Additionally, the rate of increase of hematocrit from cord sample to 30±6 hours was higher in UCM group as compared to DCC in newborn born to both anemic and non-anemic mothers. Also, UCM does not interfere with resuscitation as it can be performed in lesser time unlike DCC.

**Hence, UCM can be recommended as an alternative to DCC in all deliveries where DCC is not possible or could not be practiced for any reason.**

## Contact

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