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Comparison of umbilical cord milking versus delayed cord clamping in term neonates: a randomized controlled study

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Abstract
Background: Placental transfusion improves neonatal blood volume and iron stores. Delayed cord clamping (DCC) and umbilical cord milking (UCM) are commonly used techniques.
Objectives: To compare the effects of DCC and UCM on selected clinical and hematological parameters in term neonates.
Methods: Prospective randomized comparative study at KVG Medical College, Sullia, Karnataka (Sept–Oct 2025), including 50 term neonates.
Results: Hemoglobin and ferritin were comparable. Bilirubin was higher in DCC. NICU admission slightly higher in UCM. No mortality.
Conclusion: UCM is non-inferior to DCC and useful when delayed clamping is not feasible.

Keywords: Umbilical cord milking, delayed cord clamping, term neonate, placental transfusion

Introduction

Placental transfusion at birth is a critical physiological process that significantly influences neonatal hemodynamic stability, hematological status, and iron stores during early infancy. At the time of delivery, nearly one-third of the fetoplacental blood volume remains within the placental circulation. Strategies that facilitate transfer of this residual blood to the newborn can increase circulating red cell mass, improve iron reserves, and potentially reduce the risk of infant anemia during the first six months of life. Delayed umbilical cord clamping (DCC), typically performed 30–60 seconds after birth, is widely recommended by international bodies including the World Health Organization and the American Academy of Pediatrics. DCC has been associated with higher hemoglobin levels, improved ferritin concentrations, and better circulatory transition in both term and preterm infants.

However, delayed cord clamping may not always be feasible in clinical scenarios such as perinatal asphyxia, maternal hemorrhage, placental abruption, or when immediate neonatal resuscitation is required. In such circumstances, umbilical cord milking (UCM) has been proposed as an alternative method of achieving rapid placental transfusion. UCM involves gently stripping the umbilical cord toward the neonate several times before clamping, thereby actively transferring placental blood into the neonatal circulation within a few seconds. Previous studies have demonstrated that UCM can achieve hematological outcomes comparable to DCC while allowing early initiation of resuscitative measures.

Despite increasing clinical adoption, concerns remain regarding potential fluctuations in cerebral blood flow, hyperbilirubinemia, and hemodynamic instability associated with UCM, particularly in vulnerable neonates. Evidence in term infants remains relatively limited compared with preterm populations. Therefore, this randomized controlled study was undertaken to compare delayed cord clamping and umbilical cord milking in term neonates with respect to hematological parameters, bilirubin levels, immediate adaptation, and early clinical outcomes.

Materials and Methods

This prospective randomized comparative study was conducted in the Departments of Pediatrics and Obstetrics & Gynaecology at KVG Medical College, Sullia, Karnataka, over a two-month period from September 2025 to October 2025. The study enrolled 50 term neonates delivered in the institution who fulfilled eligibility criteria. Institutional Ethics Committee approval was obtained prior to initiation, and written informed consent was secured from parents or legal guardians.

Eligible neonates were those born at gestational age ≥37 weeks and ≤41 weeks + 6 days, from singleton pregnancies, with no major congenital anomalies and not requiring advanced resuscitation at birth. Neonates with Rh or ABO incompatibility, multiple gestation, placental or umbilical cord abnormalities, or severe perinatal complications were excluded.

Participants were randomized using sealed opaque envelopes into two groups: Group A (Delayed Cord Clamping) and Group B (Umbilical Cord Milking). In the DCC group, the umbilical cord was clamped approximately 60 seconds after birth while the neonate was held at or below the level of the placenta. In the UCM group, a 20-cm segment of the intact umbilical cord was gently milked toward the neonate three times before clamping within 10–15 seconds of delivery.

Primary outcome measures included hemoglobin concentration and serum ferritin levels at 48–72 hours of life. Secondary outcomes included total serum bilirubin levels, APGAR scores at 1 and 5 minutes, need for NICU admission, and early neonatal morbidity. Blood samples were obtained using standard aseptic techniques and analyzed in the institutional laboratory.

Statistical analysis was performed using standard statistical software. Continuous variables were expressed as mean ± standard deviation and compared using Student's t-test. Categorical variables were analyzed using chi-square or

Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant.

Results

The study included 50 term neonates equally distributed between the delayed cord clamping and umbilical cord milking groups. Maternal demographic characteristics including age, parity, antenatal hemoglobin, and mode of delivery were comparable between groups. Neonatal baseline characteristics such as gestational age, birth weight, and sex distribution also showed no statistically significant differences, indicating effective randomization.

Mean hemoglobin levels at 48–72 hours were slightly higher in the UCM group compared with the DCC group, although the difference did not reach statistical significance. Similarly, serum ferritin concentrations were comparable between groups, suggesting that both techniques achieved effective placental transfusion and neonatal iron transfer. Total serum bilirubin levels were observed to be modestly higher in the delayed cord clamping group. However, the incidence of clinically significant hyperbilirubinemia requiring phototherapy did not differ between groups. This indicates that although DCC may increase bilirubin load due to greater red cell mass, it does not necessarily translate into higher treatment requirements in term neonates. APGAR scores less than 7 at one minute were more frequently observed in the DCC group, whereas scores at five minutes were similar in both groups, indicating adequate recovery after initial adaptation. NICU admissions were slightly higher in the UCM group, primarily for transient respiratory distress and observation; none were directly attributable to the intervention technique. No neonatal mortality or serious adverse events occurred in either group.

Discussion

The present study demonstrates that umbilical cord milking provides hematological benefits comparable to delayed cord clamping in term neonates. Both techniques resulted in similar hemoglobin and ferritin levels, supporting the concept that active or passive placental transfusion can effectively augment neonatal blood volume and iron stores. These findings align with prior randomized trials and meta-analyses that have shown non-inferiority of UCM relative to DCC in term populations.

The slightly higher bilirubin levels observed in the DCC group are consistent with the physiological expectation that greater placental transfusion increases circulating red cell mass and subsequent bilirubin production. Importantly, this did not translate into increased phototherapy or morbidity, supporting the safety of both approaches in healthy term neonates. Similar conclusions have been reported in Cochrane reviews and multicenter trials.

The higher proportion of low one-minute APGAR scores in the DCC group may reflect delayed initiation of resuscitative maneuvers when immediate neonatal adaptation is suboptimal. In contrast, UCM allows rapid cord management and earlier neonatal handling, which may benefit infants requiring prompt stimulation or airway support. This practical advantage is particularly relevant in settings with limited resources or high-risk deliveries. Concerns regarding potential hemodynamic instability or cerebral blood flow fluctuations with UCM have been primarily described in extremely preterm infants. In term neonates with mature autoregulatory mechanisms, our findings suggest no clinically significant adverse effects. Nevertheless, careful technique and avoidance in compromised or very preterm infants remain prudent until further evidence is available.

Overall, this study supports the role of umbilical cord milking as a safe, effective, and feasible alternative to delayed cord clamping when the latter cannot be performed. Implementation of standardized protocols and training of obstetric and neonatal teams can optimize placental transfusion practices and improve early neonatal outcomes.

Conclusion

Delayed cord clamping remains recommended whenever feasible. Umbilical cord milking is a safe and effective alternative when immediate intervention is required in term neonates.

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