Original Article

Neonatal Anemia in Delayed Umbilical Cord Clamping

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Abstract

Objective: To determine the frequency of neonatal anemia in women with delayed umbilical cord clamping present at CDF Hospital Hyderabad.
Methodology: This Cross-sectional descriptive study was done at department of Obstetrics and Gynecology C.D.F Hospital Hyderabad, Bilawal Medical College, LUMHS, from August 2025 to January 2026. Women with term pregnancy aged 20–45 years, with a gestational age of 37 to 42 weeks, of either parity, having singleton pregnancies with neonates delivered by NVD and undergoing delayed umbilical cord clamping (DCC), were included. All the babies were further evaluating for anemia by drawing blood samples and send to laboratory for the assessment of anemia after six hours of birth and hematocrit <45% at after umbilical cord clamping was considered as anemia. All the relevant data were entered and analyzed using SPSS version 26.
Results: Overall maternal mean age was 27.7 years. Overall, 30 (16.5%) neonates were diagnosed with neonatal anemia, around more than one in four neonates found to be anemic. Multi-parity, maternal obesity and low socioeconomic status were the only statistically significant predictors of neonatal anemia in this cohort ($p<0.05$), while maternal diabetes and neonatal gender showed insignificant association with neonatal anemia ($p >0.05$).
Conclusion: The DCC observed to be a safe and effective strategy for reducing the frequency of neonatal anemia in term infants, and since it increases iron stores after birth, it may also help prevent anemia later in infancy.
Keywords: DCC, Neonatal anemia, early cord clamping, hemoglobin.

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Introduction

Neonatal anemia remains a significant global health concern, affecting approximately 40% of neonates worldwide.[1] The burden of this condition is particularly high in developing countries due to the high prevalence of maternal iron deficiency and suboptimal perinatal practices.[1,2] Neonatal anemia, which can be life-threatening, is associated with impaired oxygen delivery, poor growth, and adverse neurodevelopmental outcomes.[3]

The timing of umbilical cord clamping is an important factor influencing neonatal hematological status. Delayed cord clamping (DCC) is defined as clamping the umbilical cord 60–180 seconds after birth or after cessation of cord pulsations, whereas clamping within 60 seconds of birth is referred to as early cord clamping (ECC).[3,4] DCC allows the transfer of approximately 20–40 mL/kg of placental blood to the newborn, increasing neonatal blood volume by up to 30%. It improves neonatal hemoglobin levels and iron stores at birth, supports neurodevelopment, reduces the risk of anemia, and lowers mortality among preterm neonates.[5] This simple, low-cost intervention is particularly beneficial in low-resource settings where iron deficiency is common.[4]

In addition, DCC has been shown to reduce the incidence of intraventricular hemorrhage, facilitate lung expansion, stabilize cardiovascular transition, promote a smoother transition from fetal to neonatal life, and potentially reduce mortality by up to 27% among preterm

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infants. These benefits have led the World Health Organization (WHO) to recommend delayed cord clamping as standard practice.[5–7]

In Pakistan, umbilical cord clamping practices vary widely, and many maternity units lack written protocols, highlighting the need for standardized national guidelines.[8] The timing of cord clamping, whether early or delayed, has no significant effect on maternal postpartum hemoglobin levels. Delayed cord clamping has a well-established safety profile and does not compromise maternal well-being. It neither increases the risk of postpartum hemorrhage nor the need for maternal blood transfusion.[9] Despite substantial clinical evidence supporting DCC, its implementation remains inconsistent worldwide, and studies evaluating its effectiveness in reducing neonatal anemia have reported conflicting findings.[10]

Therefore, the present study was conducted to evaluate the effect of delayed umbilical cord clamping on the incidence of neonatal anemia. The findings are expected to contribute to the existing evidence base, support the development of standardized cord-clamping practices, and improve neonatal hematological outcomes.

Methodology

This Cross-sectional descriptive study was done at department of Obstetrics and Gynecology C.D.F Hospital Hyderabad, Bilawal Medical College, LUMHS. Study duration was six months after Ethical approval from ERC, and approval of synopsis by CPSP from August 2025 to January 2026. Overall sample size of 182 term pregnant women was calculated, based on the prevalence for neonatal anemia in delayed umbilical cord clamping around 8.33%[11], with d = 4% and CI=95%. Non-probability consecutive sampling was used. All the women with term pregnancy aged 20-45 years, having 37 to 42 weeks' gestational age (assessed by taking clinical history for last menstrual period L.M.P) either primipara or multiparous with neonate born thru vaginal delivery, singleton pregnancy with delayed umbilical cord clamping were included. However, the women with preterm births, anemic mothers (hemoglobin level <8 g/dL), twin pregnancy, antepartum hemorrhage (history of vaginal bleeding in pregnant mother or mothers present with active bleeding), RH-incompatibility (mother and baby blood groups), intrauterine growth retarded babies weight <2.5 kg and instrumental delivery and the women with pre-eclampsia/ eclampsia were excluded. All above disorders were evaluated by taking relevant clinical history and existence of medical / health record and lab tests. The maternal BMI was measured using pre-pregnancy or early pregnancy weight in (kg) and height in meters and calculated by formula as (kg/m²), which was further categorized as per WHO classification (<18.5 kg/m² = underweight), (18.5–24.9 kg/m² = normal weight), (25.0–29.9 kg/m² = overweight), and (≥30.0 kg/m² = obese). All the babies born to term pregnancies with delayed cord clamping were further evaluated for anemia by drawing blood samples and sent to laboratory for the assessment of anemia after six hours of birth. The umbilical cord clamping within 1 to three minutes was considered as delayed umbilical cord clamping. Blood sample were taken after taking informed consent from attendant of the patients, after explaining the purpose of study. Subsequently the infant with haematocrite <45% at after umbilical cord clamping was considered as anemic. All the relevant data were collected on pre-designed proforma. Moreover, the data were entered and analyzed using SPSS version 26.

Results

The overall mean maternal age was 27.7 years, with most women delivering at term (mean gestational age: 38.2 weeks). The mean neonatal birth weight was 3.03 kg, and the sex distribution was nearly equal. The mean maternal BMI was 23.7 kg/m², although 11.5% of mothers were obese. Most participants belonged to the low socioeconomic class (98.4%), and 76.9% had either primary or no formal education. Despite these socioeconomic challenges, 93.4% of women attended antenatal care. Maternal comorbidities were common, with hypertension and diabetes reported in 24.7% and 19.8% of mothers, respectively, indicating a high-risk obstetric population. Table I

Among the 182 neonates studied, 30 (16.5%) were diagnosed with neonatal anemia, while the remaining 152 (83.5%) were unaffected. This prevalence is strikingly high with more than one in three neonates found to be anemic reflecting the considerable burden of this condition within this vulnerable, predominantly low-socioeconomic cohort.

Post stratification analysis revealed that multi-parity, maternal obesity and low socioeconomic status were the only statistically significant predictors of neonatal anemia in this cohort ($p<0.05$). Meanwhile, maternal diabetes and neonatal gender showed insignificant association, identifying that the multi-parity, obesity and poverty emerged as most as significant risk factors for neonatal anemia in this vulnerable population. Table II

Table I: Baseline and clinical characteristics of the patients. (n=182)

Variable	Statistics	
Age	27.71±2.48	
Gestational age (in weeks)	38.24±1.03	
Maternal height	5.07±0.16	
Maternal weight	58.64±8.23	
BMI	23.74±3.82	
Neonate weight	3.03±0.47	
Socio-economic status		
Low class	179	98.4%
Middle class	3	1.6%
Educational status		
Illiterate	27	14.8
Primary	113	62.1
Middle	33	18.1
Secondary	9	4.9
Antenatal		
Booked	170	93.4
Un-booked	12	6.6
Parity		
Primipara	74	40.7
Multiparous	108	59.3
Apgar Score		
8-10	179	98.4
<8	03	1.6
Maternal obesity		
Yes	21	11.5
No	161	88.5
Diabetes mellitus		
Yes	36	19.8
No	146	80.2
Hypertension		
Yes	45	24.7
No	137	75.2
Smoking		
No	173	95.1
Ex-smoker	9	4.9
Neonate gender		
Male	88	48.4
Female	94	51.6

Table II: Post stratification analysis for neonatal anemia. (n=182)

Variables	Neonatal Anemia		P-value
	Yes	No	
Socio-economic status			
Low class	29 (15.9%)	150 (82.4%)	0.428
Middle class	1 (0.5%)	2 (1.1%)	
Parity			
Primi	6 (3.3%)	68 (37.4%)	0.012
Multiparous	24 (13.2%)	84 (46.2%)	
Booking status			
Booked	24 (13.2%)	146 (80.2%)	0.001
Un-booked	6 (3.3%)	6 (3.3%)	
Maternal obesity			
Yes	10 (5.5%)	21 (11.5%)	0.009
No	20 (11.0%)	131 (72.0%)	
Diabetes mellitus			
Yes	8 (4.4%)	28 (15.4%)	0.300
No	22 (12.1%)	124 (68.1%)	
Neonate gender			
Male	12 (6.6%)	76 (41.8%)	0.317
Female	18 (9.9%)	76 (41.8%)	

Discussion

The neonatal anemia remains a significant contributor to early infant morbidity, with the rising evidence of the umbilical cord clamping plays as an important role in determining the early iron stores and hematological status in newborns. The DCC has been increasingly proposed as a simple, cost-effective intervention to reduce the risk of neonatal anemia,[12] by allowing greater placental-to-fetal blood transfusion at delivery. In this study, overall maternal mean age was 27.7 years, mean gestational age of 38.2 weeks, mean BMI 23.7 kg/m² and 11.5% women being obese. Comparable findings were documented by Songthamwat M et al[13] who reported maternal mean age of 29 years in their DCC 60 seconds study groups, with slightly higher mean BMIs of 29.5 kg/m², and mean gestational age of 38.8 weeks. Similarly, in the study of Rajani H et al[14] gestational mean age was 37.7 weeks and average birth weight was 2.87 kg in DCC group. In our study, comorbidities were notably prevalent, with hypertension in 24.7% and diabetes in 19.8% of mothers, highlighting a clinically high-risk obstetric population deserving targeted healthcare attention.

In this study, among the 182 neonates, 30 (16.5**%**) were diagnosed with neonatal anemia and such prevalence is notable, with roughly one in six neonates found to be anemic, reflecting the considerable burden of this condition within this vulnerable, predominantly low-socioeconomic cohort. Prevalence of neonatal anemia significantly varies across studies. In the study of Saba K et al[15] neonatal anemia (21%) was some higher than our findings. Similarly, in the study of Songthamwat M et al[13] neonatal anemia was present in 17.7% of those in 30 sec DCC and in 10.0% of those in 60 sec DCC group, these findings almost similar to our study. In aligns to this series Phiset Jomjak M et al[16] also observe that the DCC for 60 seconds resulted in higher neonatal hematocrit levels during the first 2 to 48 hours after delivery. In another study conducted by Kc A et al[17] prevalence of anemia was 73.0% in DCC group infants at the age of 8 months, which considerably higher than the reported studies. Similarly, according to few other relevant studies the delayed umbilical cord clamping for at least two minutes in term neonates is recommended due to its beneficial effect on hemoglobin levels of newborns,[18,19] while maternal hemoglobin levels not significantly influenced either delayed or early cord clamping.[19]

Consistently Khan T et al[20] also observed that the DCC is a safe and feasible practice that decreases the need

for transfusions compared to those with early cord clamping and improves key hematological parameters in newborn babies, making it specifically valuable in areas where higher burden of infant and childhood anemia.

Moreover, in current study, multiparity, maternal obesity and low socioeconomic status were significant predictors of neonatal anemia, (<0.05) suggesting multiparity, maternal obesity and poverty as the most actionable targets for early preventive intervention against neonatal anemia in this vulnerable population. In line with these findings, in the study of Habib MA et al[21] lower socioeconomic status (p=0.008) and multiparity (p=0.023) were found to be significant predictors of neonatal anemia. Similarly, Islam GR et al[22] reported significant association between lower socioeconomic status and neonatal anemia. Consistently, a recent study conducted by Aslamzai M et al[23] also found significant association between poor household income and neonatal anemia (P = 0.03),

The prevalence of neonatal anemia observed in the present study remained relatively high despite the use of delayed cord clamping. This may be explained by the inclusion of mothers with comorbidities and the presence of significant risk factors, including multiparity, maternal obesity, and low socioeconomic status. These factors may independently and synergistically increase the risk of neonatal anemia through interrelated mechanisms. Repeated pregnancies can progressively deplete maternal iron stores, reducing fetal iron transfer in subsequent pregnancies. Maternal obesity contributes through chronic low-grade inflammation, which impairs intestinal iron absorption and placental iron transport despite the increased physiological demand during pregnancy. In addition, the predominance of low socioeconomic status in the study population may have adversely affected maternal nutrition, iron supplementation, and access to quality antenatal care, thereby increasing the risk of neonatal anemia.

This study has several limitations. It was conducted at a single center with a relatively small sample size and included mothers with comorbid conditions that may have acted as confounding factors. Furthermore, it did not include a comparison group undergoing early cord clamping or assess maternal nutritional and iron status, both of which could have influenced neonatal hematological outcomes. Future large-scale, multicenter studies with adequate control of confounding variables and direct comparisons between early and delayed cord clamping are recommended to provide more robust evidence regarding the effectiveness of delayed cord clamping in preventing neonatal anemia.

Conclusion

Study revealed that the delayed umbilical cord clamping is a simple, cost-free, and highly effective intervention that considerably reduces the neonatal anemia, specifically in newborns of multiparous and socioeconomically poor mothers. Through naturally boosting neonatal iron stores at birth, strong antenatal care and maternal nutritional support may protect not only immediate hematological health but also long-term outcomes. However due to several limitations of the study, further studies should be done excluding other all risk factors and comparing delayed cord clamping with early cord clamping, in order to more exactly observe the true impact of DCC on neonatal anemia.

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