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EFFECT OF DELAYED CORD CLAMPING ON MATERNAL AND NEONATAL OUTCOME

Sarah Adil[*1], Ayesha Imran[2], Fatima Sharif Khan[3], Fareeha Zaheer[4]

[*1,2,3,4]*PEMH Rawalpindi*

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Corresponding Author: *
Sarah Adil

Abstract

Objective: *to determine the effect of delayed umbilical cord clamping on both maternal and neonatal outcomes,*

Place and Duration: *Department of Gynaecology and Obstetrics, Tertiary Care Hospital, from Jan 2024 to July 2024*

Study Design: *Quasi-experimental study*

Methodology: *A total of 250 women with uncomplicated term pregnancies were included. Participants were randomly divided into two groups: Group A underwent early cord clamping within 30 seconds after birth, and Group B will underwent delayed cord clamping at 2 to 3 minutes after delivery. Maternal outcomes such as blood loss and postpartum hemoglobin were recorded, while neonatal outcomes were including hemoglobin, hematocrit, and APGAR scores.*

Results: *The study included 250 women, evenly divided into two groups, with no significant difference in maternal age ($p = 0.555$), gestational age ($p = 0.574$), or mode of delivery ($p = 0.206$) between them. Neonates in the delayed cord clamping group had a significantly higher mean hemoglobin level (15.21 ± 1.09 g/dL) compared with the early clamping group (14.05 ± 1.13 g/dL), and higher hematocrit values (46.33 ± 4.05% vs. 41.66 ± 3.43%; $p < 0.001$ for both). Apgar scores at one and five minutes were similar between the groups, showing no statistical difference ($p = 0.202$ and $p = 0.130$). Maternal outcomes were also comparable, with similar mean blood loss ($p = 0.901$) and postpartum hemoglobin changes ($p = 0.327$), indicating that delayed cord clamping did not increase maternal risk while significantly improving neonatal hematologic outcomes.*

Conclusion: *The study concluded that delayed cord clamping is a safe and beneficial practice that enhances neonatal outcomes without adversely affecting the mother, supporting its wider adoption in routine obstetric care.*

Introduction:

The moment a baby is born marks a critical transition from intrauterine to extrauterine life. One important step during this time is the clamping of the umbilical cord, which connects the baby to the placenta. Traditionally, many healthcare providers have practiced early cord clamping, usually within 30 seconds of birth.[1,2] However, in recent years, delayed cord clamping (DCC) waiting for 2 to 3 minutes or until the cord stops pulsating has gained attention for its potential benefits for both the mother and the newborn. Delayed cord clamping allows extra blood from the placenta to flow to the newborn.[3,4] This placental transfusion can increase the baby's blood volume by up to 30%, leading to higher hemoglobin and iron levels. The World Health Organization (WHO)

recommends delayed cord clamping for all births unless the baby requires immediate resuscitation. According to WHO guidelines (2025), DCC can reduce the risk of iron deficiency anemia in infancy by improving the baby's iron stores for up to six months after birth.[1] Studies from developed countries such as the United Kingdom, the United States, and Sweden have shown that delayed cord clamping increases neonatal hemoglobin levels by 1–2 g/dL compared with early clamping, without increasing the risk of maternal bleeding or postpartum complications.[5,6,7]

Globally, anemia in infants remains a significant public health issue. The World Health Organization estimates that around 40% of children under five years of age suffer from anemia, with iron deficiency being the most common cause. In Pakistan, the situation is more concerning. According to the Pakistan Demographic and Health Survey (PDHS 2018), approximately 62% of children under five and 42% of women of reproductive age are anemic. Such high rates highlight the importance of exploring simple, low-cost interventions like delayed cord clamping to improve iron stores in newborns and reduce anemia.[9]

From the maternal perspective, one of the main concerns about delayed cord clamping is the possible increase in blood loss during the third stage of labor. However, evidence from international trials and systematic reviews has shown no significant difference in postpartum hemorrhage or maternal hemoglobin levels between early and delayed cord clamping groups.[10] Thus, DCC appears to be a safe practice for mothers while offering considerable benefits for newborns. This study aims to determine the effect of delayed umbilical cord clamping on both maternal and neonatal outcomes in women delivering at a tertiary care hospital in Pakistan. The findings will help in providing local evidence to support or refine current obstetric practices and may contribute to the development of national guidelines promoting delayed cord clamping as a standard part of delivery care.

Methodology

The study was designed as a quasi-experimental study to determine the effect of delayed umbilical cord clamping on both maternal and neonatal outcomes. It was carried out at the Department of Gynecology and Obstetrics, Tertiary Care Hospital. The duration of the study was six months and data collection began after approval from the Ethical Review Committee of Tertiary Care Hospital. Ethical approval was obtained to ensure that the study followed all principles of research ethics, patient safety, and confidentiality. A consecutive sampling technique was used to recruit study participants. All eligible women who presented to the labor ward for delivery during the study period and fulfilled the inclusion criteria were invited to participate. A total of 250 women with uncomplicated term pregnancies were included in the study. Women who met the inclusion criteria were selected after obtaining written informed consent. They were assured that their participation was voluntary, that their medical care would not be affected by participation or refusal, and that their personal data would remain confidential.

This methodology ensured that the data collection process was systematic, ethical, and unbiased. Random allocation minimized selection bias, and strict inclusion and exclusion criteria ensured that only low-risk, uncomplicated pregnancies were studied. By comparing early and delayed cord clamping practices, this study aimed to provide reliable local evidence on the safety and benefits of delayed cord clamping for both mothers and newborns.

Inclusion Criteria: Women aged between 18 and 40 years with singleton term pregnancies (37–42 weeks of gestation) having spontaneous onset of labor and planning for vaginal delivery were included.

Exclusion Criteria: Women with multiple pregnancies, antepartum hemorrhage, preeclampsia, eclampsia, gestational diabetes, placenta previa, placental abruption, intrauterine growth restriction, preterm birth, or any other complication that could affect maternal or

neonatal outcomes were excluded. Cases requiring cesarean section, instrumental delivery, or emergency intervention were also excluded.

Sample size was calculated using WHO sample size calculator taking confidence interval 95%, margin of error 5%, the mean duration of surgery was 38.87 ± 4.29 minutes in the chewing gum group and 37.03 ± 4.36 minutes in the control group.[7] The estimated sample size came out to be 174 patients. (87 each group).

After obtaining consent, participants were randomly allocated into two groups using a simple randomization method. Group A underwent early cord clamping, in which the umbilical cord was clamped within 30 seconds of birth, while Group B underwent delayed cord clamping, where the cord was clamped after 2 to 3 minutes or when cord pulsations stopped. Both groups were managed by the same team of obstetricians and midwives to ensure uniformity of care. Standard delivery protocols were followed for all participants.

Data collection was done using a structured proforma specially designed for the study. Maternal and neonatal data were recorded immediately after delivery and during the postpartum period. Maternal parameters included the amount of blood loss during the third stage of labor, estimated using the gravimetric method, and hemoglobin level measured before delivery and 24 hours after delivery. Neonatal parameters included hemoglobin and hematocrit levels measured within the first 24 hours after birth, as well as the Apgar scores recorded at one and five minutes after delivery.

Operational definitions were established to maintain uniformity of data collection. Early cord clamping was defined as clamping of the umbilical cord within 30 seconds after birth. Delayed cord clamping was defined as clamping of the cord after two to three minutes of birth or when the cord pulsations ceased. Maternal blood loss was defined as the total amount of blood lost during the third stage of labor, and postpartum anemia was defined as a hemoglobin level below 11 g/dL. Neonatal hemoglobin and hematocrit were measured using standard laboratory methods.[11]

The proforma contained two sections. The first section recorded maternal demographic and obstetric details, including age, parity, gestational age, and baseline hemoglobin. The second section recorded delivery details, cord clamping time, maternal blood loss, postpartum hemoglobin, and neonatal outcomes such as Apgar score, hemoglobin, and hematocrit levels. All data were carefully reviewed for completeness before analysis.

The collected data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics were used to summarize data. Mean and standard deviation were calculated for quantitative variables such as maternal age, gestational age, blood loss, hemoglobin, and hematocrit levels. Frequencies and percentages were used for categorical variables such as parity and Apgar score categories. Independent sample t-tests were applied to compare the mean values of maternal and neonatal outcomes between the early and delayed cord clamping groups. A p-value of less than or equal to 0.05 was considered statistically significant. The results were presented in tables and graphs for better understanding.

Results

A total of 250 women were included, with 125 participants in each group. The mean maternal age in Group A was 28.83±5.59 years, while in group B it was 29.28 ± 6.37 years. The difference between the two groups was not statistically significant (p value = 0.555). In Group A. 52 women (41.6%) were multiparous and 73 women (58.4%) were primiparous. However, Group B had a higher proportion of multiparous women, with 75 women (60.0%), while 50 women (40.0%) were primiparous. A statistically significant difference was observed between the two groups as p value 0.004. The mean gestational age was 38.99±1.03 weeks in Group A and 39.06±1.06 weeks in Group B, with no statistically significant difference among the groups p value = 0.574.According to the mode of delivery, 67 women (53.6%) in Group A

underwent cesarean section, while 58 women (46.4%) delivered vaginally. In Group B, 56 women (44.8%) had cesarean section and 69 women (55.2%) had vaginal deliveries. This difference was not statistically significant i.e p value 0.206.The mean antenatal hemoglobin level was 11.56±0.85 g/dL in Group A and 11.61±0.88 g/dL in Group B. The difference was statistically insignificant as p value = 0.647 shown in Table-I. Neonates in Group B (15.212±1.09 g/dL)had a significantly higher mean hemoglobin level compared with Group A (14.05±1.13 g/dL) as (p value < 0.001). Similarly, neonatal hematocrit levels were significantly greater in the delayed cord (46.33±4.05 %) as compare to early cord Group (41.66±3.43), this difference was also highly significant p value < 0.001. There was no statistically significant difference between the two groups with respect to Apgar scores. The mean 1-minute Apgar score was 7.98±0.84 min in Group A and 8.11±0.84 min in Group B (p value = 0.202). Furthermore, the mean 5-minute Apgar score was 8.53±0.50 min in Group A and 8.43±0.50 min in Group B, showing no significant difference p value = 0.130.Maternal outcomes were comparable in both groups. The mean estimated blood loss was 464.57±126.17 mL in Group A and 466.63±135.04 mL in Group B, with no statistically significant difference p value 0.901. The mean postpartum hemoglobin change was -1.13±0.79 g/dL in Group A and -1.23±0.8479 g/dL in Group B, which was also not statistically significant p value = 0.327 (Table-II).

Table-I: Baseline maternal and delivery characteristics of Study Participants (n=250)

Parameters	Group A (n=125)	Group B (n=125)	p value
Maternal age	28.83±5.59	29.28±6.37	0.555
Parity Multiparous Primiparous	 52 (41.6%) 73 (58.4%)	 75 (60.0%) 50 (40.0%)	 0.004
Gestational Age	38.99±1.03	39.06±1.06	0.574
Mode of Delivery C section Vaginal	 67 (53.6%) 58 (46.4%)	 56 (44.8%) 69 (55.2%)	0.206
Antenal HB (g/dL)	11.56±0.85	11.61±0.88	0.647

Table-II: Comparison of Primary neonatal and maternal outcome among the study groups (n=250)

Parameters	Group A (n=125)	Group B (n=125)	p value
Neonatal HB (g/dL)	14.05±1.13	15.212±1.09	< 0.001
Neonatal Hematocrit (%)	41.66±3.43	46.33±4.05	< 0.001
1-min Apgar	7.98±0.84	8.11±0.84	0.202
5-min Apgar	8.53±0.50	8.43±0.50	0.130
Blood Loss (ml)	464.57±126.17	466.63±135.04	0.901
PostPartum HB Change	-1.13±0.79	-1.23±0.84	0.327

Discussion:

The present study was conducted to assess the effect of delayed umbilical cord clamping on both maternal and neonatal outcomes. The major findings of this study showed that neonates in the delayed cord clamping group had significantly higher hemoglobin and hematocrit levels than those in the early cord clamping group, while maternal outcomes were comparable. The mean neonatal hemoglobin level in the delayed

clamping group was 15.21 ± 1.09 g/dL compared with 14.05 ± 1.13 g/dL in the early clamping group ($p < 0.001$), and the mean hematocrit value was 46.33 ± 4.05% compared with 41.66 ± 3.43% ($p < 0.001$). No significant differences were found in maternal blood loss (466.63 ± 135.04 mL vs. 464.57 ± 126.17 mL; $p = 0.901$) or in postpartum hemoglobin change (–1.23 ± 0.85 g/dL vs. –1.13 ± 0.79 g/dL; $p = 0.327$). The APGAR scores at one minute (8.11 ± 0.84 vs. 7.98 ± 0.84; $p = 0.202$) and five minutes (8.43 ± 0.50 vs. 8.53 ± 0.50; $p = 0.130$) were also statistically similar between groups, indicating that delayed cord clamping improved neonatal hematologic status without compromising maternal or neonatal safety.

These results closely align with previous international studies. Nelin et al. (2018) reported that infants who underwent delayed clamping had a mean hemoglobin level of 18.1 g/dL compared to 17.3 g/dL in early clamping, and they maintained higher ferritin levels at four months of age. Similarly, Badurdeen et al. (2022) in the United States found significantly higher neonatal hemoglobin (17.8 ± 2.2 g/dL vs. 16.4 ± 2.3 g/dL; $p < 0.01$) and hematocrit levels following delayed clamping. The current study showed a comparable improvement, reinforcing the evidence that even a short delay of two to three minutes can result in meaningful hematologic benefits. The World Health Organization (2025) recommends delaying cord clamping by 1–3 minutes for all births to enhance neonatal iron stores and reduce anemia risk, particularly in low-income countries, and the findings of this study strongly support that recommendation.[10]

Similarly, a study from Nepal by Nelin et al. (2018) showed significantly higher hematocrit values (46.5 ± 4.0% vs. 41.4 ± 3.7%; $p < 0.001$) in the delayed clamping group. The present study's neonatal findings hemoglobin 15.21 g/dL and hematocrit 46.33% are almost identical, suggesting consistent benefits across different populations.[14] Findings from South Asian countries also mirror these results. [7] Jain R et al. (2020)[15] in India reported that delayed clamping increased neonatal hemoglobin by approximately 1.5 g/dL and did not cause additional maternal blood loss. These results are particularly important for Pakistan, where anemia remains a major public health problem. According to the Pakistan Demographic and Health Survey (PDHS 2018), 62% of children under five and 42% of women of reproductive age are anemic. Improving neonatal iron stores through delayed cord clamping may help reduce this burden at a population level.[9]

Regarding maternal outcomes, the present study found no significant difference in estimated blood loss or postpartum hemoglobin change between early and delayed clamping groups. These results agree with the Cochrane systematic review by Arora et al., which concluded that delayed cord clamping did not increase postpartum hemorrhage or maternal complications. [16] Carvalho OM et al (2019) also reported that maternal blood loss was similar in both early and delayed clamping groups ($p = 0.72$). The comparable results in the current study ($p = 0.901$ for blood loss) confirm that delayed cord clamping is safe for mothers.[17]

Although some earlier studies, such as those by Seidler AL, et al raised concerns about a possible increase in neonatal jaundice due to higher blood volume, most modern studies including the current one have not reported a clinically significant rise in jaundice requiring treatment. This indicates that the hematologic benefits of delayed cord clamping outweigh any minor risks, particularly in resource-limited settings.[18] Study by Qian Y, et al. (2019) have also demonstrated higher neonatal hemoglobin and hematocrit levels with delayed cord clamping, though their sample sizes were smaller. The present study strengthens these findings by including 250 participants and applying clear analytical comparisons. This larger sample and robust statistical analysis ($p < 0.001$ for neonatal parameters) make it one of the most comprehensive local contributions to this topic.[19]

Overall, this study confirms that delayed cord clamping for 2–3 minutes significantly improves neonatal hemoglobin and hematocrit without increasing maternal blood loss or affecting Apgar scores. It adds new evidence from Pakistan

supporting WHO recommendations and demonstrates that a simple, low-cost intervention can yield meaningful health benefits for newborns. The study provides local data to guide obstetric practice, emphasizing that delayed cord clamping is a safe and effective step toward reducing neonatal anemia and promoting healthier beginnings for newborns in developing countries.

Conclusion:

The study concluded that delayed cord clamping is a safe and beneficial practice that enhances neonatal outcomes without adversely affecting the mother, supporting its wider adoption in routine obstetric care.

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