

Effect of Delayed Cord Clamping on Hematological Status of Newborns Assessed at 12 Hours of Life

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ABSTRACT

Objective: To evaluate the effect of delayed cord clamping at 2 and 3 minute intervals following birth in newborns on the hematological status when assessed at 12 hours of life.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Pediatrics, Combined Military Hospital, Rawalpindi Pakistan, from Jun to Dec 2024.

Methodology: Neonates were divided into two groups based on cord clamping interval after birth, neonates delivered in Group-G2 had their cord clamping done at 2 minutes immediately after birth by the pediatric resident. Neonates in Group-G3 had cord clamping done at 3 minutes after birth. Primary variables studied were change in hemoglobin, hematocrit, and serum ferritin levels between both groups at 12 hours after birth. Maternal and demographic variables were also recorded.

Results: Hematological variables 12 hours after birth showed mean hemoglobin values of 21.01 ± 0.75 g/dl in Group-G2 versus 20.96 ± 0.75 g/dl in Group-G3 ($p=0.653$). Hematocrit assessed at 12 hours of life was 62.23 ± 0.92 percent in Group-G2 versus 62.26 ± 0.91 percent in Group-G3 ($p=0.854$). Serum ferritin values were 506.61 ± 6.30 ng/ml in Group-G2 versus 506.67 ± 6.46 ng/ml in Group-G3 ($p=0.958$).

Conclusion: We conclude that change in delayed cord clamping time of 2 and 3 minutes offer no significant advantage between increase in hematological parameters when studied at 12 hours of life even though both result in increased hematological variables when compared at birth.

Keywords: Clamp, Cord, Delayed, Early, Hematological.

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INTRODUCTION

Care of the newborn is of paramount importance in pediatrics. The immediate time following delivery holds importance. Studies have shown that protocols and maneuvers done to the newborn immediately after birth result in outcome that affect the morbidity and mortality in majority of the cases.^{1,2} Assessment of the APGAR score, baby warming, and oxygenation if required are some of the routine procedures standardized to ensure newborn safety and prevention of complications.³ The standardization of early cord clamping was initially introduced a part of maternal care triad which included oxytocin for uterine contraction, slow cord traction to prevent retention of placenta along with cord clamping but subsequent Cochrane reviews negated its role in prevention of maternal complications of retained placenta and post-partum hemorrhage.⁴ It was later proposed that early cord clamping was not beneficial for the newborn but has now favored delayed cord clamping as it more

effectively increases the hematocrit levels and iron stores.⁵ This is beneficial for the term neonate where anemia maybe an issue especially in the developed world.⁶ Assessments done at 12 hours and then at 4 months have showed significant increase when compared with early cord clamping for hematocrit and iron levels.⁷

It is well established that delayed cord clamping is superior but the time interval for delayed clamping has been a topic of debate. How long can we wait to clamp the umbilical cord for the most effective increase in hematological parameters.⁸ Delayed cord clamping has been the standard practice at our center of excellence after delivery of the newborn. The practice of early cord clamping has since been stopped in our center, but our study aims to find whether delayed cord clamping done at either 2 or 3 minute intervals offer any advantage over each other when assessing hematological parameters assessed at 12 hours of life.⁴ Since studies done between these time intervals have been scarce especially at our local demographic, it would help us standardize the time

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interval for clamping offering the best advantage to our patients.

METHODOLOGY

This quasi experimental study was carried out at the Department of Pediatrics, Combined Military Hospital, Rawalpindi Pakistan after approval from the ethical review board (vide letter no. 659 dated 03 July 2024). Minimum sample size was calculated keeping the confidence interval at 95%, power of test at 80% with mean change in hematocrit between early and delayed clamping being 3.79%.⁹ Minimum sample size calculated according to WHO calculator was 55 patients (population variance at 50). We included a total of 140 patients in our final study protocol divided into two Groups-G2 (clamping at 2 min) and Group-G3 (clamping at 3 min) with 70 participants each. The participants were sampled into two groups by non-probability consecutive method according to the given inclusion criteria. A written informed consent was taken from parents prior to delivery of newborn for inclusion in study.

Inclusion Criteria: Included all neonates born at term by either spontaneous vaginal delivery (SVD) or by Caesarian section (CS).

Exclusion Criteria: Patients with birth defects or anomalies, pre-mature neonates (<36 weeks), neonates with severe bradycardia or respiratory distress, neonates with poor APGAR score¹⁰ even after 5 min of birth, neonates requiring continuous oxygenation or intubation, low birth weight neonates, mothers with pregnancy induced hypertension, gestational diabetes, severe anemia, cholestasis of pregnancy, mother with hepatitis B and C positive PCR were excluded.

The study method included all patients as per the inclusion criteria furnished. The patients were divided into Group-G2 (n=70) and Group-G3 (n=70) as shown in figure. Neonates delivered in Group-G2 had their cord clamping done at 2 minutes immediately after birth by the pediatric resident assigned in the operating room for resuscitation and neonatal evaluation but was unaware of the study protocol. Neonates in Group-G3 had cord clamping done at 3 minutes after birth by the pediatric resident on duty in the operating room. Residents in both groups were instructed to take a blood sample immediately before clamping from the umbilical vein and was sent for hematological assessment. Once the babies were delivered, they were kept in the nursery and blood samples were again repeated at 12 hours after birth and hematological assessment was done

which included hemoglobin, hematocrit, and serum ferritin levels.

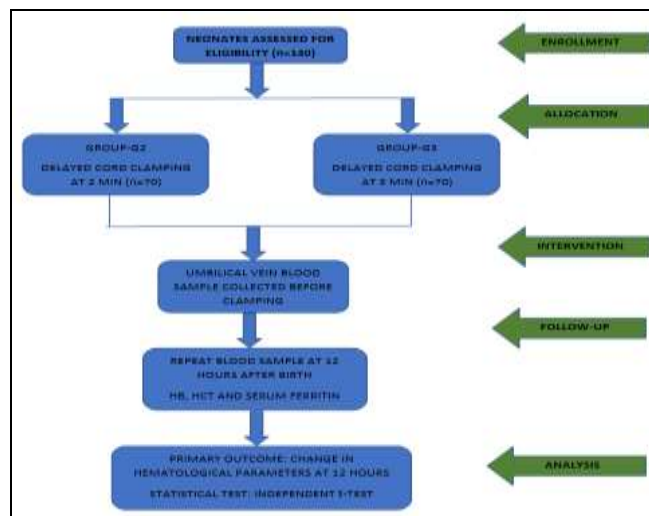


Figure: Phases of Study

Primary variables studied were change in hemoglobin, hematocrit, and serum ferritin levels between both groups at 12 hours after birth. Maternal and demographic variables were also recorded. Mean values for hematological variables and demographic variables were assessed using the independent-t test while frequency variables were compared using the Chi-Square test. Median values were compared using the Mann-Whitney U test. A p -value of ≤ 0.05 was considered statistically significant. All statistical calculations were performed using Statistical Package for Social Sciences 26.0.

RESULTS

A total of 140 patients were analyzed for the study divided into Group-G2 (n=70) and Group-G3 (n=70). Mean age of patients in Group-G2 was 38.44 ± 1.08 weeks versus 38.37 ± 1.02 weeks in Group-G3 ($p=0.689$). Mean weight of patients in Group-G2 was 3302.86 ± 240.75 grams versus 3281.43 ± 245.71 grams in Group-G3 ($p=0.603$). Gender distribution showed 33(47.1%) males and 37(52.9%) females in Group-G2 versus 36(51.4%) males and 34(48.6%) female neonates in Group-G3. Median APGAR scores assessed at 1 min post-birth were 9.00 (0.00) in Group-G2 and 9.00 (0.00) in Group-G3 ($p=0.784$). Mode of delivery showed that 41(58.6%) neonates were delivered via Spontaneous vaginal delivery and 29(41.4%) via Cesarean section in Group-G2 while 44(62.9%) were delivered via Spontaneous vaginal delivery and 26(37.1%) via Cesarean section in Group-G3 (Table-I).

Mean cord clamping time between both groups was 121.51±1.13 seconds in Group-G2 versus 181.56±1.21 seconds in Group-G3 ($p<0.001$). Hemoglobin levels assessed at birth were 19.03±0.88 g/dl in Group-G2 versus 19.07±0.87 g/dl in Group-G3 ($p=0.773$). Mean hematocrit values assessed at birth were 59.46±2.72 percent in Group-G2 versus 59.49±2.72 percent in Group-G3 ($p=0.951$). Serum ferritin levels at birth were 478.29±16.69 ng/ml in Group-G2 versus 479.09±16.26 ng/ml in Group-G3 ($p=0.774$). The same variables were assessed at 12 hours after birth showed mean hemoglobin values of 21.01±0.75 g/dl in Group-G2 versus 20.96±0.75 g/dl in Group-G3 ($p=0.653$). Hematocrit assessed at 12 hours of life was 62.23±0.92 percent in Group-G2 versus 62.26±0.91 percent in Group-G3 ($p=0.854$). Serum ferritin values were 506.61±6.30 ng/ml in Group-G2 versus 506.67±6.46 ng/ml in Group-G3 ($p=0.958$) (Table-II).

Table-I: Comparison of Demographic and Maternal Variables Among Groups (n=140)

Variable(s)	Group-G2 (n=70)	Group-G3 (n=70)	p-value
Mean Gestational Age at Birth (Weeks)	38.44±1.08	38.37±1.02	0.689
Mean Weight (Grams)	3302.86±240.75	3281.43±245.71	0.603
Gender			
Male	33(47.1%)	36(51.4%)	-
Female	37(52.9%)	34(48.6%)	-
Median Apgar Score at Birth (1 Min)	9.00 (0.00)	9.00 (0.00)	0.784
Mode of Delivery			
Spontaneous Vaginal Delivery (Svd)	41(58.6%)	44(62.9%)	-
Caesarian Section (Cs)	29(41.4%)	26(37.1%)	-

Table-II: Hematological Variables After Cord Clamping (n=140)

Variable(s)	Group-G2 (n=70)	Group-G3 (n=70)	p-value
Mean Cord Clamping Time (Sec)	121.51±1.13	181.56±1.21	<0.001
Hemoglobin at Birth (g/dl)	19.03±0.88	19.07±0.87	0.773
Hematocrit at Birth (%)	59.46±2.72	59.49±2.72	0.951
Serum Ferritin at Birth (ng/ml)	478.29±16.69	479.09±16.26	0.774
Hemoglobin at 12 Hours After Birth (g/dl)	21.01±0.75	20.96±0.75	0.653
Hematocrit at 12 Hours After Birth (%)	62.23±0.92	62.26±0.91	0.854
Serum Ferritin at 12 Hours After Birth (ng/ml)	506.61±6.30	506.67±6.46	0.958

DISCUSSION

The study was carried out to see whether there was any difference in hematological parameters of hemoglobin, hematocrit and serum ferritin levels when delayed clamping (clamping done after 1 min of birth) was done at two different intervals of 2 and 3 minutes after birth respectively. There has been

considerable association between increase in these hematological parameters when clamping was shifted in practice worldwide from early to delayed clamping from 1 minute and after one minute.^{11,12}

Cord clamping is rationalized on the basis that oxygenated blood from the mother should reach the neonate after birth till the time lung aeration is not established.¹³ The proposed hypothesis of delayed cord clamping is based on the assumption that cord clamping after 2 minutes improves oxygenation and decreases the incidence of hypoxia in newborn. Delayed cord clamping also increases serum ferritin stores in newborn through complex mechanism not fully understood.¹⁴

All neonates included in the study were at term with a median gestational age around 38 weeks. APGAR (appearance, pulse, grimace, activity, and respiration) scores were statistically comparable between both groups at 9. Presently, guidelines for delayed cord clamping for term, pre-term and those delivered by caesarian or Spontaneous vaginal delivery are being constantly updated to evaluate the best possible time providing maximum beneficial effect to the newborn.¹⁵ Since our country suffers from anemia both fetal and maternal, this simple maneuver can help in maintaining and increasing stores in our demographic setup. Some studies have postulated that prolonged or delayed cord clamping can result in hyperbilirubinemia and polycythemia, but meta-analysis done for the same have not conclusively proven this hypothesis and remains a conjecture at this point.¹⁶

Our study found that even assessment as early as 12 hours after birth showed that hematological parameters were increased including hemoglobin, hematocrit and ferritin levels when compared with sample results taken at birth in both groups but when compared between delayed cord clamping done at 2 and 3 minutes, no statistically or clinically significant differences were observed to recommend one time of delayed cord clamping to the other. We did not include long term follow-up of patients at 8 weeks and 3 months respectively due to constraints of patient follow-up, but further studies may shed light on whether the time difference affects hematological parameters when assessed after longer time durations. Studies done internationally are validated for delayed cord clamping and our study finds that even though hematological parameters increase in both groups, the difference of increase between both groups at 12 hours

of life is not statistically significant to recommend one time over the other.^{17,18}

LIMITATION OF STUDY

There were a few limitations. We did not segregate patients delivered via SVD and Caesarian section and effect of mode of delivery may need further studies. Secondly, we did not do long term follow-ups at 8 and 3 months which required further studies for conclusive results.

RECOMMEDATION

The study recommends that Recommends that early (2 min) and delayed (3 min) cord clamping provide comparable increase in hematological parameters and can be recommended as standard methods in pediatric setups.

CONCLUSION

We conclude that change in delayed cord clamping time of 2 and 3 minutes offer no significant advantage between increase in hematological parameters when studied at 12 hours of life even though both result in increased hematological variables when compared at birth.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAM & KA: Data acquisition, data analysis, critical review, approval of the final version to be published.

TH & BJ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AR & MF: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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