ORIGINAL RESEARCH

Early Versus Delayed Cord Clamping: A Quasi-Experimental Study

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ABSTRACT

Introduction: This study aimed to determine the postpartum effects of early versus delayed cord clamping on neonatal and maternal parameters.

METHODS: This quasi-experimental study was conducted on term pregnant women in labour at a tertiary care center for 1 year. Selected 340 participants were randomized into two groups equally of 170 each for Group-A Early cord clamping (ECC) within 60 seconds and Group-B Delayed cord clamping (DCC) between 60 to 180 seconds. The neonates were assessed about haemoglobin, haematocrit, polycythaemia, hyperbilirubinemia, phototherapy requirement, transient tachypnoea of newborns (TTNB), and mothers were assessed for postpartum haemorrhage (PPH). SPSS software version 20 was used to analyze the data. The p-value <0.05 was considered significant.

RESULTS: The mean maternal age (years), mean gestational age (weeks), and mean baby weight (kilograms) in Group-A were 24.56 (2.96), 38.41 (1.56), and 2.79 (0.3) respectively while in Group-B were 25.54 (3.11), 39.48 (1.85), and 2.84 (0.33) respectively. The hemoglobin, haematocrit, and total serum bilirubin levels were significantly more in Group-B (p-value <0.0001). Neonatal polycythaemia and TTNB showed a significant association in Group-B (p-value <0.0001). No significant association was seen between direct bilirubin levels, phototherapy requirement, and PPH with any group (p-value >0.05).

CONCLUSION: This study concluded that the hemoglobin and haematocrit status of newborns are improved by delaying cord clamping thus protecting neonates against iron deficiency and supporting the newborn's healthy neurological growth and development. Therefore, delayed cord clamping should be the rule in uncomplicated term deliveries.

KEYWORDS: Delayed cord clamping, early cord clamping, haematocrit, hemoglobin.

INTRODUCTION

The exact time of umbilical cord clamping is debatable for over 2000 years. The Old Testament Book of Ezekiel (16:4) contains the first mention of cord clamping (600 BC). (1) The umbilical cord's function in the infant's "nourishment" was stated by Hippocrates (300 BC) and Galen (148 AD). (1)Trotula did not mention the timing of cutting the cord but gave specific instructions for cutting the cord, including how to tie it, speak a charm while cutting it, and then wrap it "with the string of an instrument that is plucked or bowed" (2)Inch discussed the custom in prehistoric cultures and said that the cord is not cut until the placenta is delivered, sometimes hours later but it is unclear when this practice changed. (3)The practice of early cord clamping began in the 17th century with the appearance of male midwives who preferred women giving birth in bed, thus interfering with the third stage's physiologic process, which required more frequent manual removal of the placenta. (4)In 1968, Botha examined the early literature on cord clamping,

from 1668 onwards. (5)The neonatal clamp was first used to prevent the baby's blood loss prior to the umbilical vessels' physiological closure. Early cord clamping (ECC) was usually done, and the infant was then given to the paediatrician or nurse for neonatal resuscitation. (3) Early cord clamping is the practise of cutting the umbilical cord during the first 60 seconds of birth, according to the World Health Organization (WHO). (6)However, in recent years, the idea of delaying cord clamping has become almost universally emphasized.Delayed cord clamping (DCC) is described as clamping the cord within 60 to 180 seconds of birth, or once the pulsations of the umbilical cord have ceased. (6)The hemoglobin level in the umbilical cord blood is a crucial indicator of newborn anaemia at delivery. (7) Delayed cord clamping has been linked to an increase in placenta-to-neonate blood transfusions of around 80 mL, which appears to protect the baby from childhood anaemia without raising hypervolemia-related risks. (8) Delay in clamping seems to reduce the likelihood of intraventricular haemorrhage and the requirement for neonatal transfusion in preterm infants. (8)Early cord clamping is typically reasonable for the newborn's immediate care and to potentially prevent postpartum haemorrhage, but it may also result in increased Rh-sensitization. (8)Acquiring cord blood for future autologous stem cell transplantation requires early clamping and appears to be against the infant's best interests. (8)According to some studies, delayed cord clamping may have harmful effects on neonates, including a higher risk of respiratory symptoms, polycythaemia, hyperbilirubinemia, and the requirement for phototherapy. (9) This clinical study aimed to compare the effects of early versus delayed cord clamping on specific neonatal and maternal parameters during the postpartum period.

METHODS

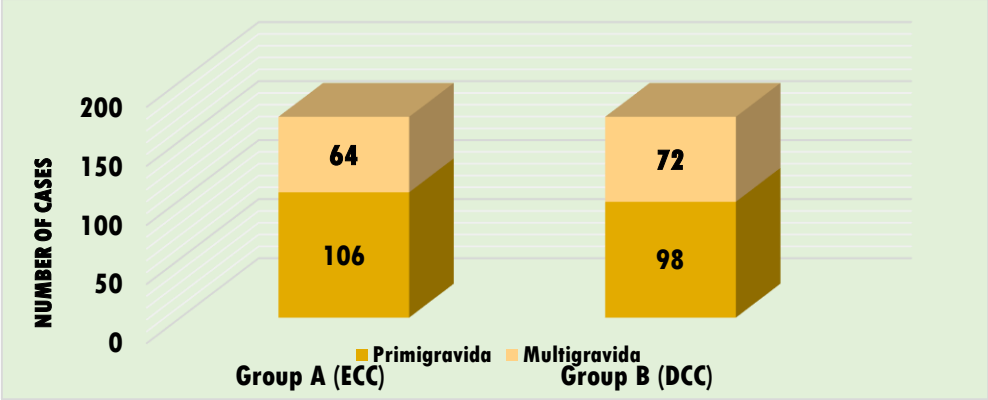
This quasi-experimental study was conductedatHind institute of medical sciences, Barabanki for one year from April 2021 to April 2022 on pregnant women in labour after obtaining approval fromthe Institutional ethical committee. Term pregnant women having vertex presenting foetus, with no high-risk factors, and undergoing vaginal delivery or caesarean section were included while those havinghigh-risk factors i.e., anemia, diabetes, gestational hypertension, cardiac disease, Rh-mismatch, multiple pregnancies, abnormal presentations, antepartum haemorrhage (APH), postpartum haemorrhage (PPH), premature rupture of membranes (PROM), oligohydramnios, polyhydramnios, Intrauterine growth retardation (IUGR), and congenital malformations were excluded. A thorough history and clinical examination were performed in all cases. After applying the inclusion and exclusion criteria, 340 pregnant women were selected for the study. After obtaining informed consent from these patients, they were enrolled andevery odd-numbered case was sent for ECC (Group A) and every even-numbered case was sent for DCC (Group B) with both groups comprising 170 study participants each.The institutional protocol was followed when managing deliveries.With patients in Group A (early cord clamping), the cord was clamped within 60 seconds, whereas with patients in Group B (delayed cord clamping), the cord was clamped between 60 to 180 seconds.All patients received an injection of 10 mg of oxytocin as a preventative uterotonic during delivery.Patients were excluded if they displayed signs of severe intrapartum foetal distress. The newborns were given immediate neonatal resuscitation, and the mother and babies shared a room. All newborns who were admitted to the NICU after delivery (other than for a brief period of observation) were not included in the study, except for those who developed transient tachypnoea of newborn.Mothers were checked for signs of atonic PPH for an hour following delivery.Maternal blood loss of more than 500 ml following a vaginal delivery or more than 1000 ml following a caesarean delivery is the standard definition of postpartum haemorrhage. (10) Neonatal blood was sent 72 hours after delivery for the assessment of haemoglobin, haematocrit, and total and direct serum bilirubin. The neonates were assessed in relation to neonatal haemoglobin, haematocrit, polycythaemia, hyperbilirubinemia, the requirement for phototherapy, transient tachypnoea of newborns (TTNB), intraventricular haemorrhage (IVH) in newbornand mothers were assessed for postpartum haemorrhage (PPH). Polycythaemia was diagnosed when the venous haematocrit was greater than 65% or the venous haemoglobin concentration was greater than 22 gram/decilitre. (11)American academy of paediatrics (AAP) nomogram for phototherapy was used to assess the requirement for phototherapy.(12) Transient tachypnoea of newborn was diagnosed if there was early start of tachypnoea (>60 breaths/min), occasionally accompanied by retractions or expiratory grunting, and infrequent cyanosis that is alleviated by low Oxygen supplementation (40%). (13) Data collected was entered on a predesigned Performa and data analysis was done using SPSS software version 20. Paired t-test was used to compare means. The Chi-square test was used to ascertain the association between the variables. The p-value <0.05 was considered significant.

RESULTS

Out of a total of 340 pregnant women at term who participated in the study, 170 were in group A of Early cord clampingand 170 were in group B of Delayed cord clamping. The mean maternal age in Group A and Group B was 24.56 (2.96) and 25.54 (3.11) years respectively. The mean gestational age in Group A and Group B was 38.41 (1.56) and 39.48 (1.85) weeks respectively.The distribution of cases with respect to gravida and mode of delivery in group

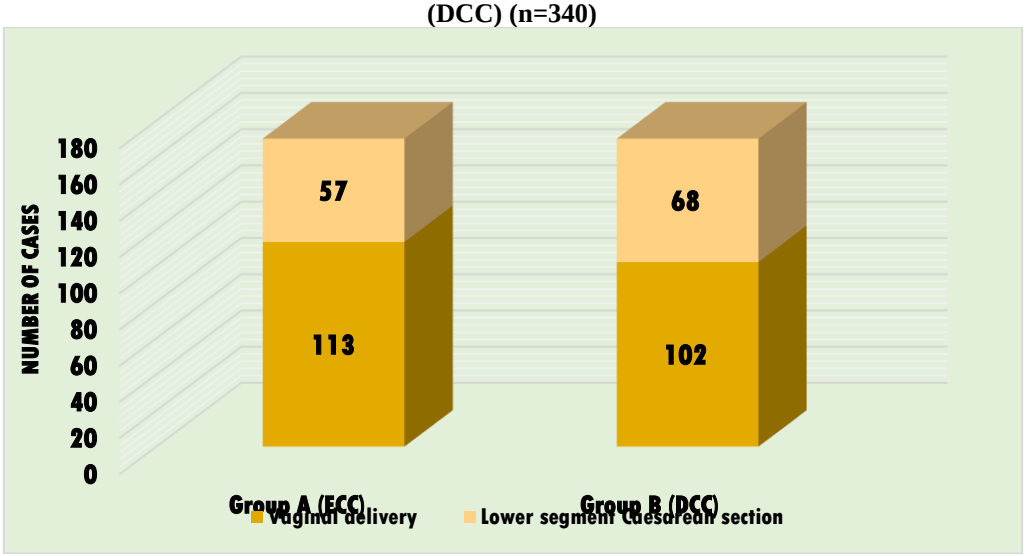
A and group B are represented in Figure 1 and Figure 2 respectively.

Figure 1: The distribution of cases with respect to gravida in group A (ECC) and group B(DCC) (n=340)



In the ECC group, the cases of primigravida and multigravida were 106 (62.4%) and 64 (37.6%) respectively while in the DCC group, the cases of primigravida and multigravida were 98 (57.6%) and 72 (42.4%) respectively.

Figure 2: The distribution of cases with respect to the mode of delivery in group A (ECC) and group B (DCC) (n=340)



In the ECC group, the cases that underwentvaginal delivery and lower segment Caesarean Section were 113 (66.5%) and 57 (33.5%) respectively. In the DCC group, the cases that underwent vaginal delivery and lower segment Caesarean Section were 102 (60%) and 68 (40%) respectively. The mean baby weight in group A and group B was 2.79 (0.3) and 2.84 (0.33) kilograms respectively. The comparison of neonatal investigations between both groups is shown in Table 1.

Table 1: The comparison of neonatal investigations between group A (ECC) and group B (DCC)(n=340)*

Neonatal parameters	Mean (Standard deviation)		t-value	p-value
	Group A (n=170)	Group B (n=170)		
Hemoglobin (gm/dl)	14.225 (1.66)	15.245 (2.29)	-5.846	**<0.0001**
Haematocrit	42.792 (5.01)	45.825 (6.87)	-5.827	**<0.0001**
Total Bilirubin (mg/dl)	5.881 (3.02)	6.591 (3.51)	-2.129	**0.035**
Direct Bilirubin (mg/dl)	0.552 (0.35)	0.606 (0.42)	-1.345	0.181

Significant P-value<0.05, gm/dl= gram/decilitre, mg/dl=milligram/decilitre.

The mean hemoglobin level (gm/dl) in ECC and DCC groups was 14.225 (1.66) and 15.245 (2.29)respectively and the mean haematocrit level in ECC and DCC groups was 42.792 (5.01) and 45.825 (6.87) respectively. Both the haematocrit and hemoglobin levels were significantly more in the DCC group (p-value <0.0001). The mean total bilirubin level (mg/dl) in ECC and DCC groups was 5.881 (3.02) and 6.591 (3.51) respectively and the mean direct bilirubin level (mg/dl) in ECC and DCC groups was 0.552 (0.35)and 0.606 (0.42) respectively. The

total serum bilirubin levels were significantly higher in the DCC group (p-value 0.035) but there was no significant difference seen with direct bilirubin levels in either of the groups (p-value 0.181).The association of neonatal and maternal parameters in Group A and Group B are represented in Table 2.

Table 2: Association of neonatal and maternal parameters in Group A and Group B (n=340)*

Parameter	Group A (n=170)	Group B (n=170)	Chi-square test value	p-value
Polycythaemia				
Yes	1	4	41.746	**<0.0001**
No	169	166		
TTNB				
Yes	5	9	57.342	**<0.0001**
No	165	161		
Phototherapy				
Yes	8	13	0.280	0.597
No	162	157		
PPH in mother				
Yes	2	3	0.036	0.849
No	168	167		

PPH = post-partum haemorrhage; TTNB=Transient Tachypnoea of Newborn; *Significant P-value <0.05

The association of neonatal polycythaemia and transient tachypnoea of newborn showed a significant positive association with Group B (DCC) while the requirement of phototherapy did not report any significant association in any of the groups (Table 3). There was no case reported of a newborn with intraventricular haemorrhage in any of the groups. Also, there was no significant association of Postpartum haemorrhage (PPH) with any of the groups (Table 3).

DISCUSSION

The ideal time for clamping the umbilical cord after delivery has been under debate for several years. This study compared the effects, advantages, and disadvantages of early cord clamping versus delayed cord clamping on specific neonatal and maternal parameters.In the present study,the hemoglobin level (gm/dl) in the delayed cord clamping group was significantly higher than in the early cord clamping group(15.245 $\pm$ 2.29 versus14.225$\pm$1.66; p-value <0.0001). This was in accordance with a study by Ofojebe et al which reported significantly higher hemoglobin levelsat 48 hours of birth in the delayed cord clamping group as compared to the early cord clamping group (16.51 ± 1.71 gm/dl versus 15.16 ± 2.27 gm/dl; p < 0.001). (14) Another similar study by Aslam et al reported significantly higher hemoglobin levels (gm/dl) in the delayed cord clamping group as compared to the early cord clamping group (16.62±2.53 gm/dl versus 15.52±1.90 gm/dl; p-value 0.001). (15)The recommended normal range of haematocrit in newborns is 42-65% until one month of age. (12) The haematocrit levels in the delayed cord clamping group were significantly higher than those in the early cord clamping group in this study (45.825$\pm$6.87 versus 42.792$\pm$5.01; p-value <0.0001). Similarly, Gonnade et al study reported significantly higher haematocrit levels in the DCC group as compared to the ECC group (48.67$\pm$ 11.27 versus 42.36 $\pm$8.69; p-value=0.002). (16) Likewise, a study by Guner et al reported significantly higher haematocrit levels in the delayed cord clamping group as compared to the early cord clamping group (62.06 ± 2.77 versus 49.30 ± 5.04; p-value < 0.001). (17)The total bilirubin levels (mg/dl) were significantly higher in the DCC group as compared to the ECC group (6.591 $\pm$ 3.51 versus 5.881 $\pm$ 3.02; p-value 0.035) while there was no significant difference in direct bilirubin levels in DCC and ECC group (0.606 $\pm$ 0.42 versus 0.552 $\pm$ 0.35; p-value 0.181). This was comparable to a study by Gonnade et al which reported similar findings i.e., significantly higher total bilirubin levels (mg/dl) in the DCC group as compared to the ECC group (4.92 $\pm$ 6.64 versus 2.06 $\pm$ 0.53; p-value 0.003) while no significant difference in direct bilirubin levels (mg/dl) in DCC and ECC group (0.48 $\pm$ 0.23 versus 0.56 $\pm$ 0.23; p-value 0.089). (16) In contrast to our study, Mercer et al study reported no significant difference in bilirubin levels in ECC versus DCC group. (18). Another opposing study by Rana et al. found no evidence linking DCC to a higher risk of hyperbilirubinemia on the first day of life or of jaundice within four weeks. (19)The findings from the present study signify that the incidence of polycythaemiaandTransient tachypnoea of newborns (TTNB)was more in the DCC group as compared to the ECC group (p-value <0.05) while the requirement of phototherapy in newborns and incidence of postpartum hemorrhages in mother was not significantly associated with either of the groups (p-value>0.05).Ranjit et al study reported a higher risk of polycythaemia in the DCC group. (20) In contrast, Ravishankar et al study reported no significant difference in polycythaemiabetween ECC and DCC groups. (21) In contrast to our study, Vural et al study reported no statistically significant difference in TTNB incidence in DCC and ECC groups. (18) Shao et al reported similar findings to our

study with no significant difference in phototherapy requirements in either of the groups. (23)Ruangkit et al study reported similar findings with no significant difference in the incidence of postpartum hemorrhages in mothers in either of the groups. (24)The limitation of this study was that it was limited to a single center only, so we may not be able to generalize of results. Therefore, further evaluation of the effects of ECC and DCC are recommended using a multicentre approachto generalize the results.

CONCLUSION

This study concluded that the hemoglobin and haematocrit status of newborns are improved by delaying cord clamping.DCC is thought to protect against iron deficiency and support the newborn's healthy neurological growth and development. Therefore, delayed cord clamping should be the rule rather than the exception in uncomplicated term deliveries.However, in the present study, DCC was associated with polycythaemia, TTNB, and raised total serum bilirubin levels but the complications in the mother were unremarkable.However, we recommend a multicentre trial with long-term follow-up.

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