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Original Research Article

A study on delayed cord clamping and early skin-to-skin contact and its effects on neonatal outcome

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ABSTRACT

Background: Previous study conducted against immediate tying and cutting of the umbilical cord and suggested waiting until the child had taken repeated breaths and the pulsation in the cord had ceased to prevent potential weakness in the child. A comparative study between delayed cord clamping (DCC) and early cord clamping (ECC) was carried out on a select group of primigravida without any high-risk factor and delivering at term. The objective of the study was to identify the effects of delayed cord clamping and early skin to skin contact on new born infant's physiological parameters (temperature, weight, SpO_2= saturation of peripheral oxygen, Apgar score= appearance, pulse, grimace, activity, and respiration, Hb=haemoglobin level).
Methods: Study sample consisted of 300 mothers and their new born after gaining mother's acceptance. They were divided into 2 groups of 150 each. Group A underwent delayed cord clamping and early skin to skin contact and group B early cord clamping. Newborns monitored 24 hours for hypothermia, apnoea, oxygen needs.
Results: The findings of the present study were equivalent among both groups regards the mean neonatal haematological parameters were comparable and slightly elevated hemoglobin level and weight status among late cord clamping compared to early cord clamping group with significant difference was observed at 24 hour later.
Conclusions: This study was found that DCC does have a beneficial effect on temperature, Apgar score, SpO_2, Hb level and weight status of new born. Therefore, it is believed that DCC and early skin to skin contact (ESSC) provides effective thermal control with a reduced risk of hypothermia.

Keywords: Apgar score, apnoea, Delayed cord clamping, Early skin to skin contact, hypothermia, Physiological parameter

INTRODUCTION

The optimal timing of umbilical cord clamping has been debated in the scientific literature for over a century. Erasmus Darwin, the English physician from the early 19th century, advised against promptly severing the umbilical cord, warning that doing so too soon could potentially weaken the newborn.[1] Early cord clamping is generally carried out in the first 60 seconds, after birth, whereas delayed umbilical cord clamping is carried out than 1-5 minutes after the birth or when cord pulsation has ceased.[2] However, the benefits of DCC in term infants are less clear. The optimal timing of cord clamping, whether it be 30 seconds or 5 minutes after birth or when the cord stops pulsating, remains controversial.[3] This article has summarized the effects of early versus delayed cord clamping on both maternal and neonatal outcomes.[4]

The American College of Obstetricians and Gynecologists (ACOG) recently published a committee opinion that

supported delayed cord clamping in preterm infants.[5] Studies have shown that DCC can improve outcomes and reduce hospital mortality in premature infants.[6] Delayed cord clamping and early skin-to-skin contact are methods that promote attachment between new-borns and their mothers. These techniques are essential for exclusive breastfeeding and ensuring that the new born stays warm and comfortable.[7]

Need of the study

The practice of early cord clamping and separating newborn infants from their mothers has become common, despite evidence suggesting it may have negative effects. Research indicates that separating newborns from their mothers may cause stress and have harmful effects that persist throughout their lives. Recent studies have demonstrated the benefits of delayed cord clamping (DCC) for both term and preterm infants.[8]

Early cord clamping and separation of mother and newborns after birth can have negative effects on both mother and infant, including hypothermia, inflammation, organ dysfunction, poor motor function, and reduced red blood cells received by the infant.[9] This can lead to short-term and long-term health problems for the newborn. Delayed cord clamping and early skin-to-skin contact are important interventions that can improve breastfeeding success, keep the newborn warm and calm, and have been shown to have multiple benefits for both term and preterm infants, including improved haemoglobin level and iron status, better neurodevelopment, and lower rates of anaemia, blood pressure, and certain diseases.[10] Because of the potential benefits of delayed cord clamping and early skin-to-skin contact, a researcher is interested in studying their effects on neonatal outcomes at S. S. Hospital in Varanasi, Uttar Pradesh.

Benefits of the study

Studies have shown that mothers who have early skin-to-skin contact with their babies after DCC have significantly higher milk production compared to those who undergo early cord clamping. Additionally, mothers who do not have skin-to-skin contact are more likely to experience interruptions in breastfeeding.[11]

Delayed cord clamping and early skin-to-skin contact are important care methods for newborn babies. Delayed cord clamping means the umbilical cord is clamped 1 to 5 minutes after birth, while early cord clamping is done within 1 minute of birth. In the first few minutes after birth, about 80 to 100 ml of blood from the placenta transfers to the baby, and in normal newborns, about 90% of this blood is transferred during the first breaths.[12] Research has shown that DCC and ESSC can increase the baby's hemoglobin levels at birth and improve iron storage in the first few months of life. This method of care helps regulate the baby's body temperature and reduces the risk of hypothermia, which can lead to other health problems like hypoglycaemia, apnoea and increase the rate and duration of exclusive breastfeeding. It also helps alleviate pain and increase alertness in infants, promoting better weight gain, infant brain development and reducing the duration of hospital stay.[13,14]

Objective

Our objective was to compare the short-term effects of delayed cord clamping and early skin to skin contact in term new-borns in the two groups. The work has been planned to achieve the following specific objectives after DCC and ESS: - To assess the temperature, SpO_2, Apgar score, Hb level and birth weight of the new-born infants.

METHODS

In this study, a descriptive observational research design was employed. The research involved comparing early cord clamping (ECC) and delayed cord clamping (DCC) in a specific group of pregnant women at full term, without any high-risk factors, during childbirth. A research study was conducted at the department of obstetrics and gynecology in Sir Sunder Lal Hospital, Banaras Hindu University, Varanasi, Uttar Pradesh. The study took place from November 2019 to December 2020 and focused on the labor room and postnatal units. Participants who met the specified criteria were included in the study. We obtained informed written consent from participants who met the eligibility criteria. The study and its objectives were carefully explained to all individuals. We employed a structured interview schedule to collect data, concentrating on demographic and obstetric details as well as medical information. For each woman, we documented basic maternal information, including age, parity, socioeconomic status, and a thorough medical history. We also recorded the diagnosis and closely observed the delivery outcomes for all eligible infants.

After childbirth, each newborn was placed on the mother's abdomen to encourage bonding between the mother and child, aiming to enhance their relationship. A pulse oximeter was used to check the newborn's saturation level, with target values of 75-85% and 85-95% at 1 minute and 5 minutes after birth, respectively. The heart rate of the newborn, with reference values of 100-150 beats per minute, was also measured at 1 and 5 minutes after birth.[15] Additionally, temperature was assessed at 5 minutes after birth, and an Apgar score was recorded to evaluate the newborns' perinatal adaptation. Other standardized procedures, such as administering 10 IU oxytocin after the baby's delivery and using controlled cord traction for placenta delivery, were consistent for patients in both groups.[16]

Next, we recorded essential neonatal details, such as birth weight, temperature, respiratory rate, Apgar score, and oxygen saturation at 5 and 10 minutes. These variables were collected following a set protocol to track the health status of the newborns. We conducted close monitoring for

two days to detect signs of hypothermia, apnoea, or the need for oxygen. Furthermore, we observed their feeding habits, weight gain, and meticulously documented any health issues, like respiratory infections and diarrhoea, that arose during this period.

We recorded the timing of cord clamping using a stopwatch. Early cord clamping occurred within 30 seconds after childbirth. Delayed cord clamping was performed at 180 seconds or after the cessation of cord pulsation, whichever happened first. The duration of the third stage of labour was measured using a stopwatch. The necessary approvals from the ethical committee in Banaras Hindu University and general medical research committee were obtained to collect the necessary data, based on the present study findings.

Inclusion criteria for newborn infants

All full-term, singleton, normally grown foetuses uncomplicated pregnancies undergoing full term vaginal deliveries in labour room at Sir Sunder Lal hospital, institute of medical sciences were recruited for the study.

Exclusion criteria for newborn infants

Mothers who refused or withdrew their participation, preterm and low-birth infants, need for neonatal resuscitation, major congenital abnormalities, fetal distress and birth asphyxia were excluded from the study.

The data were analysed using IBM SPSS version 25.0 from the USA. Qualitative data were presented as proportions, while quantitative data were expressed using mean and standard deviation. The association between two qualitative variables was examined using either the Chi-square test or Fischer's exact test. To assess the significance of the mean difference between two groups, an unpaired t-test or z-test.

RESULTS

The results show that there were significant differences between the delayed cord clamping and early cord clamping groups for several factors. The temperature of the babies, with p values less than 0.05 (<0.001) indicating a significant difference between the two groups (Table 1). The weight of the babies differed significantly between the two groups, with a p value of less than 0.05 (<0.001), (Table 2) and the same was true for the levels of oxygen in the blood (SpO_2) (Table 3). When comparing the hemoglobin levels of babies in the two groups, the statistical p value was less than 0.05 (0.00438), indicating a significant difference in Hb levels between the two groups (Table 4).

Using a chi-square test, the researchers found a significant difference in the APGAR scores between group A and group B, with a p value of less than 0.001. The graph also showed that the APGAR scores of 8 and 9 were higher in group A than group B. Based on these findings, the researchers concluded that delayed cord clamping is better than early cord clamping (Table 5). This study identified that there was noticeable change in temperature, SpO_2 and weight. Although modest, these changes were statistically significant on 2 days.

Table 1: Group statistics for temperature of baby for group A and group B.

Parameter	Group	N	Mean	SD	SE	Z value	P value
Temperature	Group A	150	98.007	0.2551	0.0208	12.324	0.001
	Group B	150	97.636	0.2658	0.0217		

Table 2: Comparison of weight of baby in group A and group B.

Parameter	Group	N	Mean	SD	Z value	P value
Weight	Group A	150	3004.567	357.2471	6.614	<0.001
	Group B	150	2752.953	299.0797		

Table 3: Comparison of SpO_2 of baby in group A group B.

Parameter	Group	N	Mean	SD	Z value	P value
SpO_2	Group A	150	97.7200%	0.45050	7.107	<0.001
	Group B	150	97.3400%	0.47530		

Table 1 shows that mean temperature of group A (98.007) was more than 97.636 of group B. Moreover, SD of group A (0.2551) was lesser than group B (0.2658). The significant difference is found at p<0.05 between group A and group B. Hence, it is inferred that delayed cord clamping at birth helps to protect new born from hypothermia than Immediate cord clamping of group B.

The birth weight in DCC group ranged between 2 kg to 4 kg with an average of 2.78 kg. This was slightly higher in

comparison to ECC group where the average was 2.64 kg (1.8 to 3.4 kg). The p value was less than 0.05 (<0.001) i.e., there was significant difference in weight between the DCC and ECC group (Table 2).

In Table 3, we compared the SpO_2 scores of babies in group A and group B. The results show that there is a difference in SpO_2 scores between the two groups.

Table 4: Comparison of Hb level of baby in group A group B.

Parmeter	Group	N	Mean	SD	Z value	P value
Hb	Group A	150	19.640	2.44751	10.723	0.000438
	Group B	150	16.940	1.87613		

In Table 4, we compared the hemoglobin levels of babies in group A and group B. The statistical analysis showed a p value of 0.00438, which is less than the commonly used significance threshold of 0.05. This indicates a significant difference in haemoglobin levels between the two groups.

In our analysis, we utilized a chi-square test to compare the APGAR scores between group A and group B. The results revealed a significant difference between the two groups, with a p value of less than 0.001. Additionally, our graph clearly displayed higher APGAR scores of 8 and 9 in group A compared to group B. Based on these findings, we concluded that delayed cord clamping is better to early cord clamping in improving newborns' APGAR scores and result in (Table 5).

Table 5: Comparison of the APGAR scores between group A and group B.

APGAR score (group A and group B)	Value	df	P value
Person chi-square	56.541	2	<0.001

Table 6: Frequency distribution of demographic characteristics of study groups.

Demographic variables	Delayed cord group		Early clod group	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Age in year				
20-25 years	107	71	110	73
26-32 years	43	29	40	27
Family type				
Nuclear	99	66	90	60
Joint	51	34	60	40
Educational status				
Under high school	20	13	40	27
High school	40	27	35	23
Intermediate	60	40	60	40
Above intermediate	30	20	15	10
Occupational status				
Employed	30	20	20	13
Unemployed	54	36	50	33
House worker	60	40	70	47
Business	6	4	10	7
Socio-economic status				
Upper	36	24	30	20
Upper middle	72	48	54	36
Middle	24	16	60	40
Lower	18	12	6	4
Locality				
Rural	90	60	98	65
Urban	60	40	52	35

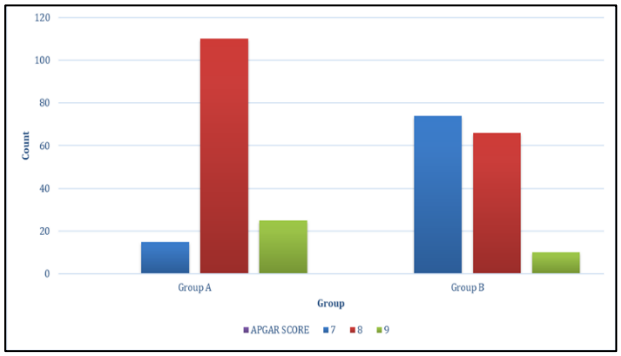

Figure 1: APGAR score for two group A and group B.

The provided demographic data for variables in the delayed cord clamping (DCC) and early cord clamping (ECC) groups. In terms of age, the majority in both groups fall within the 20-25 years range, with a slightly higher percentage in the DCC group. Nuclear family types are predominant in both groups, although the DCC group shows a slightly higher percentage. Educational status distribution shows a higher percentage of individuals with intermediate education in both groups, while the DCC group has a lower percentage of individuals under high school education compared to the ECC group. Occupational status indicates a higher percentage of houseworkers in the DCC group, whereas the ECC group has a slightly higher percentage of unemployed individuals. Socio-economic status reveals a larger proportion of individuals in the upper middle class in both groups, with a slightly higher percentage in the DCC group. Finally, the locality distribution indicates a higher percentage of rural residents in both groups, with a slightly larger rural population in the DCC group. These findings underscore the importance of considering various demographic factors when analysing the outcomes of cord clamping practices.

DISCUSSION

Main findings

The DCC and ECC groups showed no significant differences in age, education, income, working status, family type, and diet. Both groups had similar demographic characteristics, and the distribution within the groups was uniform.

Interpretation of the study

This study focused on willing mothers for participation, and the findings indicated that delaying cord clamping for more than 3 minutes or waiting until the cord pulsation stopped did not have a significant impact on the infant's haemoglobin level at 2 days compared to the group where the cord was clamped within 30 seconds (ECC group).

The secondary analyses, including per-protocol and as-treated analyses, did not alter the outcomes. In this specific group, where over 80% of mothers exclusively breastfed, the study's results align with findings from previous research conducted in diverse racial groups.[17,18] On the contrary, a study conducted in India demonstrated significantly higher haemoglobin (Hb) concentrations in the delayed cord clamping (DCC) group. In this study, birth weights and Hb levels in infants were notably higher than those observed in the current study.[19] Another study, which similar the timing of cord clamping in Mexican trial, revealed that DCC had a more pronounced impact on body iron and stored iron in infants born to mothers with low ferritin levels, as opposed to infants born to mothers with normal ferritin levels.[20]

The recommendation for the timing of cord clamping may vary based on the characteristics of women and neonates. The only values that showed a significant increase with delayed cord clamping (DCC) compared to early cord clamping (ECC) were hemoglobin (HB) levels at 2 days, as analysed through the intention-to-treat principle, per protocol analysis, and as-treated analysis. In all analyses, values fell within the normal range for both groups (DCC=57% versus ECC=52-53%), with an approximately 4.5% higher mean in the DCC. This could suggest the potential positive impact of delayed cord clamping (DCC) in preventing neonatal anemia. These findings align with previous studies that observed a significantly higher hematocrit with DCC, with one study proposing that these effects persisted for up to 2 months. None of these studies reported any adverse outcomes related to the elevated hematocrit. While no statistically significant differences were observed, there was a mean difference of 88.5 gm in infant weight, and weights tended to be higher in the DCC group.[21]

This study had some limitations. Firstly, it used an observational design and a convenient sampling method in just one hospital, making it hard to apply the findings to a broader context. Secondly, there was a requirement to assess the tool within 48 hours after childbirth, which might have limited the completeness of the data. An additional limitation is that our study exclusively focused on full-term, low-risk deliveries involving healthy mothers from a well-nourished population. Therefore, the findings may not be applicable to term infants with diverse perinatal risk factors, such as maternal diabetes or intrauterine growth restriction. Women exclusively completed the questionnaires after giving birth.

CONCLUSION

The present study emphasizes the effectiveness of delayed cord clamping (DCC) combined with early skin-to-skin contact immediately after birth for full-term newborns. This study contact has a positive impact on the stability of physiological parameters, including increased temperature, heart rate, respiratory rate, hemoglobin levels and breastfeeding rate in neonates. This approach doesn't require specialized equipment and is a cost-free procedure. Future studies should be sufficiently powered to accurately

identify the genuine advantages and disadvantages of cord clamping on outcomes. Additionally, these studies should comprehensively report details of their methods. It is recommended that future research compares neonatal outcomes, including haemoglobin levels, follow-up on iron status, and assessments of physical and psychological health, as well as short- and longer-term neonatal outcomes.

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