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Original Research Article

A Study to Investigate the Effect of the Timing of DCC on Neonatal Outcomes

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Abstract

Aim: The aim of the present study was to investigate the effect of the timing of DCC on hemoglobin levels, neonatal outcomes and developmental status in neonatal.

Methods: The study was conducted at Department of Obstetrics and Gynecology, IGIMS, Patna, Bihar, India. upon birth and at four months old on infants born to 200 pregnant women presenting to a healthcare center affiliated to IGIMS, Patna, Bihar, India for one year.

Results: The results obtained showed no significant differences between the two groups in terms of the mothers' mean age. The mean level of umbilical cord blood hemoglobin was significantly higher in the intervention group compared to in the controls; the infants in the intervention group had developed jaundice more frequently than the controls, although there were no significant differences between the two groups in terms of the need for phototherapy. Studying the infants in terms of the different dimensions of their development at four months old showed problem-solving to be the only dimension in which the two groups differed, as the intervention group received higher scores for it nevertheless, no significant differences were observed in terms of the other dimensions and the overall score.

Conclusion: The present study concluded that delays in umbilical cord clamping can significantly elevate umbilical cord hemoglobin levels; however, it also increases the risk of neonatal jaundice and has no effects on developmental status, except in the problem-solving dimension.

Keywords: Umbilical cord clamping, Hemoglobin, Child Development.

Introduction

Delayed cord clamping (DCC) is a high-impact, low-cost, evidence-based recommended intervention in preterm and term newborn infants. On the other hand, the optimal timing of DCC has always been a hotly debated issue. The recommended timing for DCC varies between the guidelines: World Health Organization (2014) recommends DCC over 1–3 minutes. Neonatal Resuscitation Protocol (NRP, 8th Edition, 2020) by the AAP/AHA and American College of Obstetrics and Gynecology (ACOG) recommends DCC at 30–60 sec. National Institute for Health and Care Excellence (NICE, 2017) recommends DCC over 1 minute or longer if the mother requests, International Federation of Obstetrics and Gynecology recommends DCC at 30 seconds in preterm infants <34 weeks of gestational age and 30 seconds to 3 minutes in term infants. [1-5] DCC in full-term neonates leads to increased iron stores, higher hematocrit, and polycythemia. However, it does not increase the risk of symptomatic polycythemia, or hyperbilirubinemia requiring phototherapy. [6]

DCC is associated with short-term benefits in preterm neonates, including reduced incidence of intraventricular hemorrhage, necrotizing enterocolitis, sepsis, and mortality. Moreover, the additional short-term benefits of DCC in preterm infants include: an increased hematocrit at birth, decreased risk of anemia, decreased need for blood transfusions, and better long-term neuro-developmental outcomes. [2,6] There has always been a theoretical concern about the increased risk of hypothermia with a longer duration of DCC. Neonatal hypothermia, directly and indirectly, contributes to an increased risk of neonatal morbidities and mortality. [7] The greatest risk of hypothermia occurs within the first few minutes of life because of the wide variation in environmental temperature from intrauterine life to extrauterine life. [8] It has been observed that the temperature of

lambs was better maintained with DCC than with conventional care and immediate cord clamping. [9]

DCC can be associated with a reduced risk of iron deficiency anemia in term infants and affect neonatal iron storage and neurodevelopment in the long term. [10,11] Hemoglobin levels are significantly lower in newborns with their umbilical cord clamped within less than one min from birth 24-48 h after birth compared to those with DCC. The risk of iron deficiency was two times higher in these children at age three to six months. [12]

The aim of the present study was to investigate the effect of the timing of DCC on hemoglobin levels, neonatal outcomes and developmental status in neonatal.

Materials and Methods

The study was conducted at Department of Obstetrics and Gynecology, IGIMS, Patna, Bihar, India upon birth and at four months old on infants born to 200 pregnant women presenting to a healthcare center affiliated to IGIMS, Patna, Bihar, India for one year.

The inclusion criteria consisted of age 18 to 35 months, and the mother's parity being four or less.

The eligible mothers had no pregnancy complications such as diabetes, cardiovascular and renal-pulmonary diseases, preeclampsia, placental abruption and polyhydramnios. The mothers' most recent delivery had not required the use of forceps or vacuum extractors and was not accompanied with complications such as hemorrhage, dystocia or prolonged labor. In addition, there was no history of known developmental (genetic) disorders or congenital anomalies in either parent's families. The infants were also not born through delayed or preterm birth, their birth Apgar score was at least 7, their birth weight was above 2.5 kg and their physical health was confirmed at four months old by a physician of the health center. After gaining accommodation letter, the researcher visited the research setting and briefed the mothers on the study objectives.

After ensuring of the mothers' eligibility and obtaining their informed consent for participation, the researcher proceeded to sampling. The infants were randomly assigned to two groups. The timing of umbilical cord clamping was 90-120 sec after birth in the intervention group and less than 60 sec in the control group. Blood samples were then taken from the infants' umbilical cord vein and transferred to the laboratory for measuring their hemoglobin level. All the tests were performed by a laboratory technician using the same device. The Ages and Stages Questionnaire (ASQ) was used to examine the infants' developmental status at four months old.

The data collection tools consisted of information sheets including demographic, medical, pregnancy and childbirth data and forms associated with the eligibility criteria and the infants' birth profile. A spectrophotometer was used for measuring the infants' hemoglobin level. To assess the children's developmental status, the literate parents were asked to complete the ASQ. The validity of the information sheets was confirmed using the content validity method and their reliability was assessed using test-retest. The spectrophotometer was calibrated and its validity was confirmed by the manufacturer. Its reliability was also confirmed using test-retest. The ASQ is a globally valid tool with a validity of 83% and a reliability of 90%. The data collected were analyzed using SPSS ver.19 (Chicago, IL, USA).

Results

Table 1: Comparison of the demographic details in the intervention and control groups

Variables		Intervention Group N=100	Control Group N=100	P-value
Mean &SD of Mother age		29.72±5.08	30.68±5.35	0.512
Mean &SD of Father age		34.96±5.25	35.85±5.85	0.412
Level of Mother education Frequency(percent)	Primary	4 (4)	3 (3)	
	High school	66 (66)	70(70)	
	Diploma	18 (18)	18 (18)	
	College	12 (12)	8 (8)	0.122
Level of Father education Frequency(percent)	Primary	4 (4)	3 (3)	
	High school	62 (62)	60 (60)	
	Diploma	20 (20)	21 (21)	
	College	14 (14)	16 (16)	0.142
Mother'sEmployment (frequency/percent)	Unemployed (Housewife)	80 (80)	79 (79)	
	Employed	20 (20)	21 (21)	0.112
Infants' Gender (frequency/percent)	Boy	48 (48)	51 (51)	
	Girl	52 (52)	49 (49)	0. 275
Mean &SD of birth weight (gr)		3203.51±301.51	3259.32±361.93	0.07
Gestational age(week)		38.78±0.967	38.64±0.81	0.149

The results obtained showed no significant differences between the two groups in terms of the mothers' mean age.

Table 2: Comparison of umbilical cord blood hemoglobin and neonatal complications in the intervention and control groups

Variables	Intervention Group N=100		Control Group N=100		P-value
Umbilical cord blood hemoglobin(g/dl) Mean±SD	15.98±1.44		14.39±1.68		0.034
Jaundice (frequency/percent)	80 (80)		30 (30)		0.020
	Need to Phototherapy		Need to Phototherapy		
	+	_	+	_	0.316
	24	48	12	18	
Gastrointestinal Infection (frequency/percent)	12 (12)		8 (8)		0.214
Respiratory Infection (frequency/percent)	18 (18)		20 (20)		0.110

The mean level of umbilical cord blood hemoglobin was significantly higher in the intervention group compared to in the controls; the infants in the intervention group had developed jaundice more frequently than the controls, although there were no significant differences between the two groups in terms of the need for phototherapy.

Table 3: Comparison of the infants' scores for the different dimensions of development in the intervention and control groups

Dimensions of development	Intervention Group N=100	Control Group N=100
	Mean±SD	Mean±SD
Communication	54.46±8.64	52.28±8.52
Gross motor	53.45±6.34	54.36±5.35
Fine motor	48.22±7.23	48.24±6.94
Problem-solving	54.41±5.43	41.98±6.32
Personal-social	48.32±8.22	49.34±7.94

Studying the infants in terms of the different dimensions of their development at four months old showed problem-solving to be the only dimension in which the two groups differed, as the intervention group received higher scores for it nevertheless, no significant differences were observed in terms of the other dimensions and the overall score.

Discussion

Despite the medical advances in the diagnosis and treatment of diseases, developmental delays in children are still considered a global health challenge in both developed and developing countries. [13] Developmental delay generally refers to children who fail to achieve their age-appropriate developmental milestones. Developmental and behavioral problems are the most common pediatric disorders, following infection and trauma. [14] Around 200 million children across the world are estimated to not have accomplished or to not be on the path of accomplishing their age-appropriate development.[15] This condition is highly prevalent even in developed countries, but does not have a uniform prevalence throughout the world; in high-risk populations, its prevalence can reach as high as 30%. [16]

The results obtained showed no significant differences between the two groups in terms of the mothers' mean age. The mean level of umbilical cord blood hemoglobin was significantly higher in the intervention group compared to in the controls; the infants in the intervention group had developed jaundice more frequently than the controls, although there were no significant differences between the two groups in terms of the need for phototherapy. No significant differences were found between the two groups examined in terms of the effect of the timing of umbilical cord clamping on hemoglobin levels, although serum ferritin levels were 45% higher in the DCC group than in the early clamping group, suggesting a statistically significant difference; however, no cases of iron deficiency anemia in these groups were observed. [17] Early umbilical cord clamping could reduce hemoglobin levels in infants at two months old and that a delay in clamping, even by two minutes, can increase iron reserves in term infants and thus improve their blood status before age six months. [18] The timing of umbilical cord clamping had a significant effect on blood volume and red blood cell mass and that holding the infant below the level of the placenta and a few minutes of delay in clamping the umbilical

cord can increase the infant's blood volume by 40%. [19]

Studying the infants in terms of the different dimensions of their development at four months old showed problem-solving to be the only dimension in which the two groups differed, as the intervention group received higher scores for it nevertheless, no significant differences were observed in terms of the other dimensions and the overall score. A clinical trial was conducted to examine the effect of delayed umbilical cord clamping on infants' development at four months old and found better problem-solving skills in the delayed umbilical cord clamping group, which is consistent with the present findings. [20] The Ages and Stages Questionnaire scores had no differences between late and early clamping. [21]

Conclusion

The present study concluded that delays in umbilical cord clamping can significantly elevate umbilical cord hemoglobin levels; however, it also increases the risk of neonatal jaundice and has no effects on developmental status, except in the problem-solving dimension.

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