International Journal of Medical and Health Invention
ISSN (Online): 2319 – 6718, ISSN (Print): 2319 – 670X
www.ijmhsi.org Volume 2 Issue 2 ǁ July-Dec. 2020 ǁ PP.18-22

Original Research Article

The role of Delayed Cord clamping in improving the Outcome in Preterm Babies: a comparative study.

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Received: 12 Aug 2020 Revised: 18 Sep. 2020 Accepted: 30 Sep. 2020 Published: 01 December 2020

Aim: *To compare between immediate and delayed cord clamping in preterm infants less than 37 weeks, and its effect on the outcomes.*
Material and methods: *This study was conducted at department of Obstetrics & Gynaecology and Paediatrics at Darbhanga Medical College and Hospital, Darbhanga India for a period of 1 year in the preterm babies born in the hospital. The total number of babies included in the study was 200 preterm, where the protocol of DCC was applied on 110 preterm. We compared infants who received DCC with ICC who was clamped immediately after birth, because they were born before the protocol implementation.*
Results: *DCC was performed on 110 infants; and 90 infants were identified as control. Gestational age, birth weight, and other demographic variables were similar between both groups. There were no differences in Apgar scores or admission temperature, but significantly fewer infants in the DCC group were intubated in delivery room, had respiratory distress syndrome, or received red blood cell transfusions in the first week of life compared with the control group. A significant reduction was noted in the incidence of IVH in the DCC compared with the historic control group, after adjustment for gestational age, an association was found between the incidence of IVH and DCC. IVH was significantly lower in the DCC compared with control group.*
Conclusion: *Implemented DCC process successfully in a large delivery hospital. DCC, as performed in our study, was associated with a significant reduction in IVH and early red blood cell transfusion.*
Keywords: *Delaying Umbilical Cord Clamping, Preterm Infant, Intra Ventricular Hemorrhage*

I. INTRODUCTION

The umbilical cord of every newborn is clamped and cut at birth, yet the optimal timing for this intervention remains controversial. For at least over 200yrs, multiple controversies have arisen around the timing of umbilical cord clamping. The timing for cord clamping vary from early cord clamping generally done immediately after birth whereas later cord clamping usually involves clamping the umbilical cord greater than 30 seconds after the birth or when cord pulsation has ceased.[1] According to the newer neonatal resuscitation guidelines 2015 (American heart Association for cardiopulmonary resuscitation and emergency cardiovascular care 2015 recommendations, part 13) delayed cord clamping after 30 sec is suggested for both term and preterm neonates who do not require resuscitation at birth.[2,3]

In a series of small studies of blood volume changes after birth, it was reported that 80–100 mL of blood transfers from the placenta to the newborn in the first 3 minutes after birth and up to 90% of that blood volume transfer was achieved within the first few breaths in healthy term infants.[4-6] Because of these early observations and the lack of specific recommendations regarding optimal timing, the interval between birth and umbilical cord clamping began to be shortened, and it became common practice to clamp the umbilical cord shortly after birth, usually within 15–20 seconds. However, more recent randomized controlled trials of term and preterm infants as well as physiologic studies of blood volume, oxygenation, and arterial pressure have evaluated the effects of immediate versus delayed umbilical cord clamping (usually defined as cord clamping at least 30–60 seconds after birth).[7,8] Delayed umbilical cord clamping appears to be beneficial for term and preterm infants. In preterm infants, rates of intraventricular hemorrhage and necrotizing enterocolitis are lower, and fewer newborns require transfusion when delayed umbilical cord clamping is employed. Furthermore it has been found that delayed cord clamping is associated with better pulmonary and systemic vasodilatation due to significant fall in peripheral and pulmonary vascular resistances and consequently higher blood flow to the brain, body, and intestines.[9,10] In preterm infants it was associated with a better cardiopulmonary adaptation and subsequently decreased dependence on supplemental oxygen or fewer days of assisted ventilation.[9,11,12]

The aim of our study is to compare between immediate and delayed cord clamping in preterm infants less than 37 weeks, and its effect on the outcomes of such babies

II. MATERIAL AND METHODS

This study was conducted at department of Obstetrics & Gynaecology and Paediatrics at Darbhanga Medical College and Hospital, Darbhanga India for a period of 1 year in the preterm babies born in the hospital .The total number of babies included in the study was 200 preterm, where the protocol of DCC was applied on 110 preterm. The study period for the historic cohort was also one year. Collected data included maternal demographics, obstetric complications, any antenatal steroid and magnesium use, and other labor and delivery variables. Neonatal data included gestational age, birth weight, sex, and post-delivery data variables such as Apgar scores, resuscitation data, and the infant's temperature upon admission to the neonatal intensive care unit. Other clinical variables included treatment with phototherapy.

Methodology

All infants born at less than 37 weeks' gestation were eligible for DCC, unless they met the following exclusion criteria: severe maternal illness that prompted immediate delivery, placental causes (abruption or previa) or fetal causes (multiple gestation, major congenital anomalies, severe growth restriction, or hydrops fetalis). After birth, the infant was left unstipulated, attached at or slightly below the level of placenta for 45 seconds. The cord was then clamped and cut, and the neonatal team initiated resuscitation efforts. Apgar timing was initiated at the time of birth when the infant was delivered completely. We placed the baby at or below the level of the placenta as feasible. Because most of the preterm deliveries in our institution were caesarean sections, it was a challenge getting the baby truly below the level of the placenta. Because good evidence is emerging in more mature infants, the optimal timing and positioning in a very preterm infant still must be explored. A large percentage of deliveries did not receive DCC because of our predefined narrow eligibility criteria. The DCC being beneficial or harmful in these higher risk excluded infants (such as multiple gestations, growth restricted, and other vulnerable preterm groups) must be explored carefully in the future.

Statistical analysis

The recorded data was compiled entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages, means and standard deviations were calculated. Statistical test applied for the analysis were chi-square test and student t-test.

III. RESULTS

Table 1: Maternal demographic and clinical data

Maternal Data	DCC (N=110)	**%**	ICC (N=90)	**%**	**P value**
Maternal Age (Years), (Mean±SD)	25.3±6.6		25.2±5.3		0.814
Artificial reproductive therapy	3	2.72	2	2.22	0.719
Number of CS	68	61.8	61	67.7	0.907
Chorioamnionitis	2	1.8	2	2.2	0.830
Gestational DM	5	4.5	8	8.8	0.669
Pre-eclampsia	2	1.8	5	5.5	0.741
Poly or oligohydramnios	7	6.3	9	10	0.920
Ante-natal steroid	99	90	74	82.2	0.541
Mg sulfate	2	1.8	3	3.33	0.876

Table 2: Infants' Demographic and Clinical Characteristics after delivery

Infants Data	DCC (N=110)	ICC (N=90)	P value
Gestational age (Weeks), Mean±SD	34.1±2.2	34.16±2.01	0.418
Birth Weight (grams), Mean±SD	1315±360.12	1230±411.17	0.319
Gender			
Male, N (%)	52 (47.3)	44 (48)	0.497
Female, N (%)	58 (52.7)	46 (52)	0.803
Apgar Score at 1min,median (range)	9 (3-10)	9 (3-10)	0.711
Apgar Score at 5min, median(range)	9 (4-10)	9 (4-10)	0.701
Admission Temperature, Mean±SD	35.7±2.1	35.8±2.02	0.521
Initial blood glucose, Mean±SD	71±27.8	49±17.1	0.036*
Initial mean blood pressure, Mean±SD	28±4.6	31±5.1	0.179
Intubation in the delivery room, n (%)	5 (4.54)	8 (8.88)	0.029*
PH, Mean±SD	7.2±0.06	7.2±0.07	0.633
PCO2 mmHg, Mean±SD	46±12.8	45.1±11.2	0.704
PO2 mm Hg, Mean±SD	57±29	61.1±20.2	0.819

* indicates statistical significance

Table 3: Infant morbidity during NICU stay

Infants Morbidity	DCC (N=110)	**%**	ICC (N=90)	**%**	P value
Blood transfusion after 1 wk of birth	39	35.45	46	51.1	0.021*
Corticosteroid	67	60.90	54	60	0.914
Phototherapy	79	71.81	45	50	0.034*
RDS-use of surfactant	68	61.81	75	83.33	0.022*
Assisted Ventilation	70	63.63	77	85.5	0.032*
Days on oxygen, mean ± SD	45±14.3		49±16.7		0.314
IVH	24	21.81	25	27.7	0.018*
Suspected NEC	9	8.18	18	20	0.014*

* indicates statistical significance

IV. DISCUSSION

There are several factors that contributed to the high rate of compliance with DCC in DMCH First, the process was developed with substantial inter professional coordination between the departments of obstetrics and neonatology that resulted in standardized protocol and narrow eligibility criteria to overcome perceived barriers. In addition, the extensive implementation plan included staff education, simulation exercises, and interim monitoring. Finally, this intervention was incorporated into our Golden Hour protocol that has objectives and processes for preterm infant care in the delivery room that we have used successfully in our practice. Our study agreed with other studies about delayed cord clamping in preterm infants. Many obstetricians and neonatologists share the same concern regarding DCC in preterm infants, which are adverse outcomes that result from delay in the resuscitation of infants.[13-17] We found that, despite delaying resuscitation briefly, Apgar scores, other resuscitation parameters, and mean admission temperature were not different between the DCC and control group. Additionally, a significantly lower number 5/110 (4.54%) of infants in the DCC were intubated in the delivery room. More infants were breathing spontaneously after DCC, which contributes to the success of non-mechanical ventilation. This supports the general hypotheses that DCC at birth decrease the need for resuscitation by promoting a more physiologic transition to extra uterine life.[18,19] Our observed reduction in the incidence of RDS and surfactant administration adds evidence to the recommendation of DCC for decreased incidence of RDS.[20,21]

In our study, preterm babies who needed blood transfusion were lower 39/110 (35.45%) in the DCC group compared to ICC group 46/90 (51.1%), this was in agreement with physiologic studies in preterm infants, which have shown that a transfer from the placenta of approximately 80 mL of blood occurs by 1 minute after birth, reaching approximately 100 mL at 3 minutes after birth. This additional blood can supply extra iron, amounting to 40–50 mg/kg of body weight. This extra iron, combined with body iron (approximately 75 mg/kg of body weight) present at birth in a preterm newborn, may help prevent iron deficiency during the first year of life.[22,23]

According to Mark Sloan, M.D., whether a baby "is premature or full term, approximately one-third of its total blood volume resides in the placenta. This is equal to the volume of blood that will be needed to fully

perfuse the fetal lungs, liver, and kidneys at birth. In addition to the benefits that come with adequate iron stores. Babies whose cords are clamped at 2 to 3 minutes-and thus, who have an increased total blood volume compared with their immediately-clamped peers-have a smoother cardiopulmonary transition at birth.[24,25] Another potential benefit of delayed cord clamping is to ensure that the baby can receive the complete retinue of clotting factors." In other words, the increased volume of blood will naturally increase blood platelet levels, which are needed for normal blood clotting.[26,27] In our study, the number of babies who needed phototherapy in the DCC group (71.81 %) were significantly higher than ICC group (50 %). One analysis found a very slight (2%) increase in jaundice among babies who received delayed cord clamping. However, according to the Thinking Midwife, "The only studies available involve the administration of an artificial oxytocic (syntocinon or syntometrine) in the 'delayed clamping' group IV syntocinon is associated with jaundice. Therefore, it could be the oxytocic making a difference here– not the clamping. Other studies, found "that the difference between early and late cord clamping for clinical jaundice did not reach statistical significance. Another concern sometimes mentioned is polycythemia, or blood that is too thick to properly oxygenate tissues. Researchers also looked at this issue and did not find anything statistically significant.[28,29] Our study showed significantly lower number of patients with IVH (21.81%) and suspected NEC (8.18%) in DCC group. There is growing evidence that enhanced placental transfusion by delaying umbilical cord clamping (DCC) in preterm infants may improve hemodynamic stability after birth and decrease the incidence of major neonatal morbidities, such as intraventricular hemorrhage (IVH) and necrotizing enterocolitis (NEC).[29,30] Delayed clamping also results in an infusion of "stem cells, which play an essential role in the development of the immune, respiratory, cardiovascular, and central nervous systems, among many other functions. The concentration of stem cells in fetal blood is higher than at any other time of life. ICC [immediate cord clamping] leaves nearly one-third of these critical cells in the placenta. Stem cells may also "help to repair any brain damage the baby might have suffered during a difficult birth".[31, 32]

This study has several limitations. Thus, conclusions from this study are limited to associations. Confounding of the results by other changes in practice is also a risk. However, our practice did not change much during the study period other than more widespread use of non mechanical ventilation in very preterm infants. This might have had some impact on our lower intubation and surfactant administration rates. The radiologists reading the cranial ultrasound scans were not blinded formally, but they were not aware of the implementation of DCC. There is also the question of generalizability because the data reported are from a single center. Despite these limitations, we believe it is important to share our observations, which more likely reflect the real world clinical practice and address some of the concerns that are impeding the widespread practice of DCC in preterm infants.

V. CONCLUSION

DCC, as performed in DMCH, was associated with significant reduction in incidence of IVH. DCC in preterm infants appears to be safe, feasible, and effective with no adverse consequences. Our study demonstrates that implementation of the DCC process with standardized protocol in preterm infants is feasible and effective with improved outcomes. In conclusion, we have implemented DCC process successfully in a large delivery hospital. DCC, as performed in our hospital, was associated with a significant reduction in IVH and early red blood cell transfusion. Further clinical studies are needed to optimize the timing and technique of DCC and to report the impact of this potentially valuable procedure on long term neuro developmental outcomes of the preterm infants.

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