

Effects of Delayed Cord Clamping on Neonatal Jaundice, Phototherapy and Early Haematological Status in Term Neonates Born by C Section

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Abstract

Background: Neonatal iron deficiency anemia (IDA) is an important problem that has multiple sequelae to long-term cognitive, emotional, and behavioral development of new-borne. Delayed cord clamping (DCC) can protect against neonatal IDA in neonates by transferring residual blood in the placenta. This practice is easy, effective and without cost [1,2]. Hyperbilirubinemia is considered a potential disadvantage of DCC, while in practice, it does not appear to be associated with increased phototherapeutic demand [3-5]. This study was conducted to observe the hematological improvement like Hemoglobin and hematocrit levels in a term neonate who underwent delayed cord clamping without requirement of phototherapy for neonatal jaundice.

Methods: Randomized control study was performed in a tertiary care teaching hospital Bagalkot between January 2021 and May 2022 after obtaining informed consent and institutional ethical committee clearance among those who fulfilled the inclusion and exclusion criteria. Patient were the term neonates born by caesarean section in OBG department, HSK hospital based on inclusion/exclusion criteria.

Venous samples were tested for hematocrit and hemoglobin at 48hrs of life. Transcutaneous bilirubin (TcB) screening levels were estimated who were found clinically icteric on day 3 of life, if TcB levels were high, venous sample for serum bilirubin level were estimated.

Results: Mean hematocrit in DCC group was higher than in ECC group [58.9 (5.5) vs 47.14 (5.8) P < 0.05]. Mean hemoglobin in DCC was higher than in ECC group [19.59 (1.41) vs 16.7 (1.3) P < 0.05]. Rate of phototherapy was 13.5% in ECC and 11.8% in DCC group. DCC at 30 - 60 seconds resulted in the higher neonatal hemoglobin level on day 3 without a higher rate of phototherapy (P value > 0.05).

Conclusion: In caesarean section, delayed cord clamping for 30 - 60s improved the early hematological status of term neonates without the enhanced requirement of phototherapy for neonatal jaundice. DCC at 30 - 60 sec is simple, effective and safe procedure that can be recommended in term C-section in preventing IDA.

Keywords: Anemia; Caesarean Section; Delayed Cord Clamping; Early Cord Clamping; Neonatal Jaundice; Phototherapy

Abbreviations

IDA: Iron Deficiency Anemia; DCC: Delayed Cord Clamping

Introduction

Iron deficiency anemia in neonates is a worldwide concerned health issue because of its relationship with poorer cognitive, motor, auditory and social emotional function [9,10]. Placental transfusion provides sufficient iron reserves for the first 3 to 6 months of life; thus, preventing or delaying the development of iron deficiency until the use of iron-fortified foods is implemented [11]. As a simple and safe procedure, DCC proves to be beneficial for a better hematological status in the first several days or months of full-term new-borne life, including hemoglobin, hematocrit levels [3,6-8]. Thus, the implementation of DCC should be advocated.

Most randomized controlled trials focused on the population of neonates delivered vaginally. However, the pattern of placental transfusion in vaginal delivery is different from that in caesarean section. In the 1960s, Yao, *et al.* demonstrated that the blood volume of full-term neonates born through vagina increased by 19.3% at 1-min-delayed cord clamping and 32% when umbilical cord pulsation ceased [12]. Under the condition of caesarean section, clamping the cord beyond 40s reversed the net flow between the placenta and neonate, resulting in a rebound of the residual placental blood volume [13]. A systematic review and meta-analysis revealed caesarean section was related to a less placental transfusion compared with vaginal delivery [14].

It is reasonable that the role of DCC in the two delivery methods is inconsistent, and this topic is of great clinical significance. Several studies focused on the effect of DCC on early neonatal hematological status in neonates born to the mothers who underwent caesarean section, but the results were inconsistent [15,16]. In this study, to investigate the benefits of DCC and its optimal timing in term caesarean section, we fully assessed the effects of DCC (30 - 60s) in term neonates with caesarean section, the rate of phototherapy and hemoglobin and hematocrit levels of neonates on the first three days.

Materials and Methods

This is Randomized control trail conducted in tertiary care teaching hospital (Bagalkot) over the period of 18months after taking ethical clearance. Eligible participants are enrolled in studies after meeting inclusion criteria. Randomization was done based on computer generated sequencing and samples allotted equally in each study group ECC (Early cord clamping) and DCC (delayed cord clamping).

Inclusion criteria:

1. Singleton pregnancy;
2. Term pregnancy with the gestational age of 37 - 42 weeks;
3. Delivered by elective caesarean section;
4. Neonates: birth weight of 2500 - 4000g;
5. Mothers: Rhesus D-positive blood.

Exclusion criteria:

1. Not cried at birth;
2. Neonates with congenital malformations (anal atresia, biliary atresia, heart disease), pneumonia, and any other diseases influencing serum bilirubin levels;
3. Pregnancy with hypertension disorders, diabetes mellitus, intrahepatic cholestasis of pregnancy, polyhydramnios, oligohydramnios, placenta previa, and placental abruption.

This study included ECC group at 15s and DCC group at 30 to 60s women enrolled in this study were allocated in respective study group via computer generated sequencing.

Baseline characteristics were recorded, such as age, gestational age, fetal birth weight, and Apgar scores at 1 min and 5 min blood samples were drawn after 72 hours of life and tested for hemoglobin and hematocrit.

The neonatologist decided to implement phototherapy when the neonates were considered hyperbilirubinemia based on transcutaneous and serum bilirubin levels.

Results

90 women were enrolled in our study, of which the distribution is 45 cases in the ECC group and 45 cases in the DCC group.

There were no significant differences in age, gravidity, parity, gestational age, newborn birth weight, newborn sex and Apgar score at 1 min and 5 min between the ECC group and DCC group or DCC subgroups ($p > 0.05$) (Table 1). The median time of cord clamping was less than 15s in the ECC group, 30s TO 60s in the DCC group.

	Early Cord Clamping	Delayed Cord Clamping	P Value
Mothers age	28.8 ± 3.5	29.2 ± 4.1	> 0.05
Gestational age (In weeks)	38.8 ± 0.8	38.9 ± 0.78	> 0.05
Newborn weight	2.8 ± 0.3	2.81 ± 0.3	> 0.05
APGAR score (1 Min)	9	9	> 0.05
APGAR score (5 Min)	10	10	> 0.05

Table 1: Baseline characteristics.

The hematological status of neonates on day 3 was shown in table 2.

	Early Cord Clamping	Delayed Cord Clamping	P Value
Hemoglobin (On Day 3)	16.7 ± 1.3	19.5 ± 1.41	< 0.05
Hematocrit (On Day 3)	47.14 ± 5.8	58.9 ± 5.5	< 0.05
Polycythemia	0	0	-

Table 2: Hematological status of the neonates.

On the third day, the hemoglobin level in the DCC group ($n = 45$; 19.5+ g/L) was significantly higher than that in the ECC group ($n = 45$; 16.7+1.3 g/L) ($p < 0.05$). similarly on third day hematocrit levels in DCC group ($n = 45$; 58.9+5.5) was significantly higher than that in the ECC group ($n = 45$; 47.14+5.8) ($p < 0.05$).

The number of admissions to NICU due to yellowish discoloration of skin in both ECC and DCC group shows that delayed cord clamping did not increase the requirement of phototherapy in neonatal jaundice compared with ECC group.

Study variables	ECC	DCC	P value
Total underwent	45	45	-
Total admissions	14	11	-
Dehydrations and inadequate milk secretion	12	9	-
Yellow discoloration	2	2	-
Requiring phototherapy	2	2	-

Table 3: Neonatal admissions.

Discussion

Professional guidelines on delayed cord clamping are constantly updated. The ACOG recommended at least 30 - 60s in preterm and term neonates. To date, the optimal timing of DCC in caesarean section remains uncertain. In our study, we defined DCC as a delay of cord clamping for at least 30s, which was consistent with the ACOG guideline. We investigated the short-term effects of DCC at different time on neonatal jaundice, the rate of jaundice requiring phototherapy and the early hematological status of new-borne.

Clamping the cord at 30 - 60s significantly increased the rate of neonatal polycythemia without the enhanced requirement of neonatal phototherapy and other adverse outcomes.

The report from Japan Nakagawa M, Ishida Y, *et al.* observed that DCC led to a higher risk of neonatal jaundice requiring phototherapy in healthy term new-borne. The different findings may be due to the diversities in the study design, the sample size, and the study population. The difference between our previous study and the current study is due to different delivery methods. It was reported that caesarean section was associated with a less placental transfusion compared with vaginal delivery. Therefore, delayed cord clamping in healthy term neonates is a safe procedure during caesarean section without apparent harmful effects on the neonates and their mothers.

For term neonates, several randomized controlled trials had reported DCC resulted in improved hemoglobin levels at birth or within the three days of life, which was in agreement with our results [3,6,17,18]. But few studies took the effect of different delivery methods on DCC into account. The pattern of placental transfusion differed between vaginal delivery and caesarean section delivery. Our study demonstrated delayed clamping at 30 - 60s (the median time 53.5s) increased hemoglobin and hematocrit levels on the third day after birth [17,18].

Limitation of the Study

Limitations of this study include the small blood sample size of the DCC group on day 3 for the ethical reason that is an invasive procedure, and focusing on the effects of DCC in caesarean section on short-term hematological status rather than long-term hematological effects. The strength of this study was repeated measurement in bilirubin level and blood indicators, ensuring the accuracy of the effect of DCC on neonates. Additionally, our trial was one of the few research projects on the implementation of DCC during caesarean section.

Conclusion

In caesarean section, a delay in cord clamping for at least 30 s improved the haematological status of term neonates on day 3 of life without the enhanced requirement of phototherapy for neonatal jaundice. Delayed cord clamping at 30 - 60s is a simple, economical, effective and safe procedure that can be recommended in term babies born through elective caesarean section.

Conflict of Interest

None.

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