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Paediatrics Section

# Adopting Delayed Cord Clamping in Neonates who Cry/Breathe at Birth: A Quality Improvement Project at a Tertiary Care Hospital in Bengaluru, Karnataka, India

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## ABSTRACT

**Introduction:** Delayed Cord Clamping (DCC) involves waiting to clamp the umbilical cord for a duration of usually 60 seconds to three minutes following the baby's birth. This practice has garnered increasing attention due to its potential to significantly improve neonatal outcomes.

**Aim:** To increase DCC rates at study Institute, by about 80% in neonates who breathe and cry at birth.

**Materials and Methods:** This Quality Improvement (QI) study was carried out in the Department of Paediatrics at Dr. BR Ambedkar Medical College and Hospital in Bengaluru, Karnataka, India, from 1st September 2023 to 15th October 2023 (a period of 6 weeks). This project was planned and conducted with a multidisciplinary team and aimed to increase DCC rates among deliveries conducted (fitting the inclusion criteria) in the Institute, abiding by the World Health Organisation (WHO) protocol.

**Results:** This QI project increased rates of DCC with each Plan-Do-Study-Act cycle (PDSA), ultimately meeting the aim over six weeks, increasing from zero to 87.87%.

**Conclusion:** Simple and inexpensive interventions, such as providing education, repetitive reinforcement and collaborative teamwork with minimal resources, quickly led to improvements in DCC rates. DCC presents significant benefits for neonatal health, particularly in improving iron status and supporting cardiovascular and respiratory transitions.

**Keywords:** Early cord clamping, Neonatal blood transfusion, Plan-do-study-act cycle

## INTRODUCTION

The ideal timing for umbilical cord clamping after a baby's delivery has been a topic of discussion for decades. In the mid-20th century, early clamping of the umbilical cord emerged as a common practice [1]. According to the WHO guidelines from 2014, delayed umbilical cord clamping (DCC) should be performed more than one minute after birth or once cord pulsation has stopped [2]. Growing evidence suggests that DCC benefits both term and preterm infants by improving haemoglobin levels and iron status, supporting neurodevelopment, reducing anaemia and resulting in higher blood pressure. Additionally, DCC is associated with fewer transfusions and lower rates of Intraventricular Haemorrhage (IVH), chronic lung disease, necrotising enterocolitis and late-onset sepsis [3].

Potential drawbacks of DCC include the risk of polycythaemia, jaundice and a greater need for phototherapy, as well as possible maternal postpartum haemorrhage or the necessity for maternal blood transfusions [3]. DCC is preferred over Early Cord Clamping (ECC) in all neonates, including preterms and low birth weights and for both normal deliveries and cesarean sections. Absolute contraindications to DCC are few and include conditions like foetal hydrops, the urgent need for maternal or neonatal resuscitation, impaired uteroplacental circulation and confirmed instances of twin-to-twin transfusion syndrome or twin anaemia-polycythaemia sequence [4].

Physiological studies in term infants indicate that about 80 mL of blood is transferred from the placenta within the first minute after birth, with this volume increasing to approximately 100 mL by three minutes post-delivery [5,6]. Ceriani Cernadas JM et al., observed that DCC in term newborns for one to three minutes enhanced venous haematocrit levels within a normal range at six hours post-birth and reduced the incidence of neonatal anaemia, without causing any adverse effects on either the infants or their mothers [7]. Chaparro CM et al., demonstrated that in normal-weight, full-term infants in Mexico, delaying cord clamping for two minutes significantly improved iron levels at six months of age compared to ECC at 10 seconds [8].

Andersson O et al., conducted a series of follow-up studies examining the effects of DCC on neurodevelopment in infants, assessing outcomes from four months to four years of age. They found that, compared to ECC performed in less than 10 seconds, DCC for 180 seconds or more did not affect overall neurodevelopment in full-term infants up to four months of age. However, it was associated with improved problem-solving skills and lower scores in personal-social development [9]. Katheria AC et al., found that delaying cord clamping for five minutes was associated with higher blood pressure at 12 hours of life in term infants [10]. In several clinical trials, the adoption of a DCC policy resulted in a decreased incidence of IVH in preterm singleton infants born between 24 and 34 weeks of gestation [11,12]. Aziz K et al., observed that implementing DCC for 45 seconds in babies born between 28 and 32 weeks of gestation was associated with lower rates of necrotising enterocolitis [13].

Therefore, implementing a simple intervention like DCC could potentially offer numerous clinical benefits for neonates. Hence, this QI project aimed to adopt DCC to increase DCC rates by about 80% in those neonates who breathe and cry at birth.

## MATERIALS AND METHODS

The current QI project was conducted in the Department of Paediatrics at Dr. B.R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India, from September 1, 2023, to October 15, 2023 (a period of 6 weeks). The present study received approval from the Institutional Review Board (EC-372).

**Inclusion criteria:** All babies delivering at study Institute >/= 28 weeks of gestation were included in the study.

**Exclusion criteria:** Babies who do not cry or breathe at birth, babies < 28 weeks of gestation, apnoeic infants, apparently lifeless infants or those with no spontaneous respiration within 20-30 seconds, infants with anaemia due to isoimmunisation, active bleeding due to placental laceration, abruption, disruption, cord avulsion, true knot, hydropic infants and recipient twins with twin-to-twin transfusion syndrome were excluded from the study.

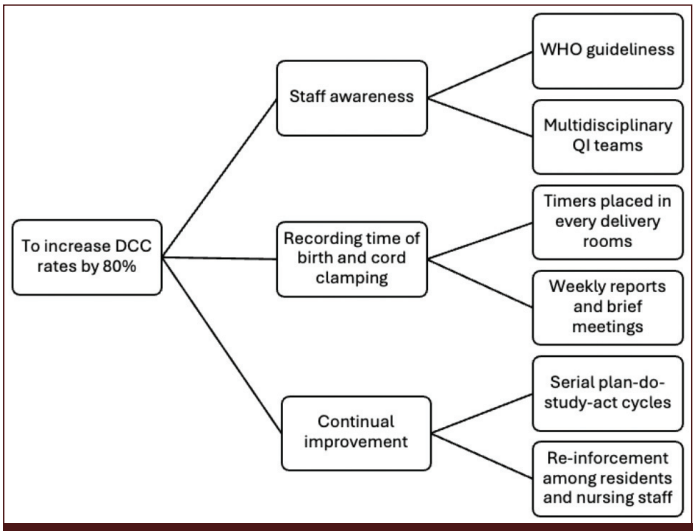
**Sample size estimation:** The sample size included all the deliveries which were conducted during the study period.

### Study Procedure

Approximately 400 deliveries are performed each year in the study Institute. The preintervention (baseline) data for week zero was collected by observing the percentage of deliveries where umbilical cord clamping was delayed for one minute or longer. The delivery room personnel were not informed that the cord clamping time was being recorded.

After determining that the baseline DCC rate was 0% (5 deliveries over that week), a multi-disciplinary team was formed. This committee included a paediatrician, an obstetrician, a paediatric resident, an obstetrics and gynaecology resident, as well as nursing staff from both the labour room and the operating theatre. The aim statement was to achieve umbilical cord clamping at one minute or later in 80% or more of all deliveries within six weeks following the initial meeting.

The team established a key driver to facilitate the achievement of the study's aim [Table/Fig-1]. The members created individualised PowerPoint presentations, grand round lectures and conducted comprehensive training sessions for all labour and delivery staff on the new DCC protocols, including the physiological benefits of DCC, practical implementation strategies and education about potential complications such as jaundice and polycythaemia.




**[Table/Fig-1]:** Key driver.

In addition, the team established a uniform protocol for DCC applicable to all delivery methods. According to the protocol, after the neonate's complete vaginal delivery or extraction during a cesarean section, the umbilical cord was to be clamped after a one-minute delay, aligning with the WHO guidelines. During this time, the newborn is wrapped in a warm, dry, sterile towel and positioned 10 cm below the introitus for vaginal deliveries or placed on the operating table beside the mother during cesarean sections. Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores were recorded at the time of delivery, independent of the timing of cord clamping. Following delivery and DCC, the routine care of the newborn remained unaffected by the study.

The expert team developed inclusion and exclusion criteria for DCC, but ultimately, the obstetrician decided to provide DCC in each delivery. The team members developed informational materials and sessions to educate expectant parents on the benefits of DCC, ensuring informed consent. The team used visual reminders and checklists to reinforce adherence to the protocols.

Additional modifications included updating the delivery room documentation to incorporate a section for noting the time of cord clamping. The update added a statement: the cord was clamped, with two options for DCC (a) done (b) not done. If the latter option was selected, an explanation of why the umbilical cord was clamped early was documented.

The post-intervention data was collected and analysed every week. All data for the study participants were recorded using the standard predesigned proforma as per the study objectives. Before birth, the gestational age of the newborn was assessed by antenatal scans (using ultrasonography) carried out before 18 weeks of gestation. After delivery, details such as mode of delivery, time of delivery, time of cord clamping and the reason for failed DCC were recorded.

## STATISTICAL ANALYSIS

The statistical analysis for the present study was primarily descriptive, focusing on summarising and characterising the data using frequency and percentage calculations. Microsoft Excel was employed as the software tool, utilising its built-in functions to efficiently compute these statistics.

## RESULTS

Preintervention data revealed that DCC was not performed due to unawareness and lack of adherence to the existing guidelines. This QI project increased the rates of DCC from zero to 87.87%. The rates of DCC progressively increased with each PDSA cycle conducted weekly. By the end of the six weeks of data collection, DCC rates consistently met the aim of 80% or higher.

Over six weeks, a total of 39 deliveries (23 normal vaginal deliveries and 16 lower segment cesarean sections) were conducted, out of which six babies did not meet the inclusion criteria of the study. All six babies were excluded because they did not cry or breathe at birth and required resuscitation. DCC was successfully performed for 29 babies (87.8%), while it could not be performed for 4 babies (12.2%) [Table/Fig-2]. The reasons for the failure of DCC were insufficient staff for simultaneous deliveries during night shifts (3 LSCS) and new staff (1 NVD) who had missed the seminar classes on changes in cord clamping protocols. In the first four weeks of the study period, it was difficult to comply with DCC; however, compliance improved later with regular PDSA cycles [Table/Fig-3].

| Parameters | Number |
|---|---|
| Total deliveries | 39 |
| NVD | 23 |
| LSCS | 16 |
| Inclusions | 21 (NVD) + 12 (LSCS)= 33 |
| Exclusions | 2 (NVD) + 4 (LSCS)= 6 |
| DCC done | 20 (NVD) + 9 (LSCS)= 29 (87.87%) |
| DCC not done | 1 (NVD) + 3 (LSCS)= 4 (12.12%) |

**[Table/Fig-2]:** Descriptive data of DCC.
* NVD: Normal vaginal delivery; * LSCS: Lower segment caesarean section

| Weeks | Total deliveries | Normal vaginal deliveries | LSCS | Exclusions | DCC not done (mode of delivery) |
|---|---|---|---|---|---|
| 1 | 7 | 4 | 3 | 1 | 1 (LSCS) |
| 2 | 5 | 3 | 2 | 2 | 1 (NVD) |
| 3 | 8 | 7 | 1 | 0 | 1 (LSCS) |
| 4 | 5 | 2 | 3 | 2 | 1 (LSCS) |
| 5 | 4 | 3 | 1 | 0 | 0 |
| 6 | 10 | 4 | 6 | 1 | 0 |
| Total | 39 | 23 | 16 | 6 | 4 |

**[Table/Fig-3]:** Weekly report on DCC.

## DISCUSSION

This QI project increased rates of DCC with each PDSA cycle, meeting the aim over six weeks, rising from zero to 87.87%. QI projects seek to enhance patient care by designing, testing and implementing improvements through real-time measurement using PDSA cycles. Pauley AN et al., conducted a QI study to delay the umbilical cord clamping time in all neonates, thereby improving the DCC rates from 12% to 96% [4]. Another study by Bolstridge J et al., specifically focused on infants weighing less than 1,500 g at birth and their protocol recommended DCC at 60 seconds [14]. In a study by Ruangkit C et al., cord clamping at 30 seconds was performed and only newborns born at less than 34 weeks of gestation were included [15]. Both projects achieved DCC rates greater than 70%. Another QI project by Peterson J and Ranganna R, focused exclusively on preterm infants and successfully increased the rates of deferred cord clamping from 0% to 45% [16]. In contrast, this study included all newborns, with the aim for cord clamping to occur at greater than or equal to one minute after birth, achieving an overall DCC rate of 80%.

McDonald SJ et al., conducted a Cochrane systematic review that included 15 trials with a total of 3,911 women and infant pairs, concluding that DCC significantly increases early haemoglobin concentrations and iron stores in infants [17]. Raju TN and Singhal N, concluded that delaying cord clamping for 30-60 seconds after birth, with the baby positioned below the placenta, is associated with several neonatal benefits, including improved transitional circulation, enhanced establishment of red cell volume and a reduced need for blood transfusions [18].

A 2009 study conducted by Blouin B et al., at a hospital in Peru demonstrated that the relationship between the timing of cord clamping and infant anaemia was influenced by the mother's anaemia status [19]. The study revealed that DCC significantly helps prevent anaemia in infants born to anemic mothers, showing benefits at both four and eight months of age. In 2011, Blouin B et al., demonstrated that a simple two-component intervention could effectively shift hospital policy and practice from early to delayed umbilical cord clamping [20]. This study could shift hospital policy and practice from early to delayed umbilical cord clamping through a straightforward QI initiative.

To ensure the continued success and improvement of DCC practices, several key recommendations are proposed. First, sustained education and training programs are vital for maintaining high compliance rates among staff and ensuring they remain informed about the latest best practices related to DCC. Continuous monitoring through regular audits and feedback mechanisms is also essential to ensure ongoing adherence to DCC protocols and to quickly address any emerging challenges. Additionally, it is crucial to engage and educate parents in the decision-making process regarding DCC to foster informed consent and enhance overall satisfaction. Finally, long-term follow-up of babies who undergo DCC should be conducted to assess neurodevelopmental outcomes and evaluate the risk-benefit ratio, which would provide valuable insights for future QI studies.

### Limitation(s)

The study had several limitations that should be taken into account when interpreting the results. First, as a single-centre study conducted in a tertiary care hospital, the generalisability of the findings to other settings, such as rural hospitals or institutions with different patient demographics and resources, may be limited. Second, the implementation and sustainability of DCC protocols require additional resources, including time for staff training and parent education. Resource constraints could impact the consistency and effectiveness of protocol implementation. Lastly, the attitudes of both parents and healthcare providers toward DCC may influence the study outcomes. Resistance to change from key stakeholders could affect the success of the intervention.

## CONCLUSION(S)

The DCC is a fundamental component of high-quality perinatal care. This project improved the DCC rates from zero to more than 87.8% over six weeks. This QI study faced several challenges, including resistance to changing established practices. A wide range of approaches, such as weekly reports and QI team meetings with repeated education about the benefits, helped overcome these obstacles to QI progress. Simple and inexpensive interventions, like provider education, repetitive reinforcement and collaborative teamwork with minimal resources, quickly led to improvements in DCC rates. Moreover, the simplicity of this system can contribute to the long-term sustainability of DCC. Future efforts should focus on sustaining these improvements and expanding research to further validate and refine DCC practices.

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