

## CORD CLAMPING: THE CRITICAL FIRST FEW MINUTES

The first few minutes and hours after birth are critical for a child's long-term development. For instance, increasing evidence suggests that rapidly clamping the umbilical cord is detrimental to the infant's health. Meanwhile, skin-to-skin contact is essential to build bonds and encourage breastfeeding.

The materials in your professional pack and on the Mum & Baby Academy website help you advise and support mothers about cord clamping. The Mum & Baby Academy estimates that completing this module is equivalent to one hour of CPD.

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In association with:



### LEARNING OBJECTIVES

#### After studying this Clinical Review you should:

- Appreciate the adverse outcomes associated with early cord clamping and the benefits of delayed cord clamping.
- Feel empowered to help mothers and healthcare professionals avoid early cord clamping.
- Understand the potential association between the time of cord clamping and breastfeeding.
- Appreciate the importance of tactile stimulation, such as skin-to-skin contact, in development and bonding.

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## Abstract

The umbilical cord continues to pulsate for several minutes after birth<sup>1</sup> and so continues to propel blood into the infant. Generally, early (also referred to as “immediate” or “premature”) cord clamping refers to clamping in the first 60 seconds after birth. Delayed cord clamping (DCC; also referred to as “deferred”, “late” or “optimal”) is generally performed at least one minute after the birth or after the umbilical cord stops pulsating.<sup>2</sup>

DCC increases blood volume by up to 30% for children born at term and by 50% for preterm infants compared to early cord clamping. As a result, DCC has several benefits including improving neonatal systemic blood pressure and cerebral oxygen perfusion; reducing the need for blood transfusions; and lowering the risk of necrotising enterocolitis. Furthermore, DCC reduces the risk of intracranial haemorrhage almost two-fold.<sup>3</sup>

Emerging evidence suggests that DCC may also improve long-term outcomes. For instance, infants whose cords were clamped and cut early were twice as likely to be iron deficient at 3 to 6 months compared with DCC.<sup>3</sup> In addition, DCC seems to protect very low birth weight male infants against motor disability at 7 months<sup>1</sup> and markedly increases delivery of stem cells to the baby.<sup>3</sup>

Therefore, further studies should ascertain whether DCC influences the likelihood that the child will develop conditions that are putatively associated with stem cell deficits, including autism, allergies and diabetes. Many studies evaluating DCC were retrospective and used different definitions of ‘delayed’. Prospective studies using a standardised definition are needed.

Because of the increasing evidence supporting DCC, the National Institute for Health and Care Excellence (NICE) recommends that healthcare professionals do not clamp the cord earlier than one minute from the birth of the baby unless there is a concern, such as the cord’s integrity or the baby’s heartbeat is below 60 beats per minute and is not getting faster. Healthcare professionals should clamp the cord between 1 and 5 minutes after birth followed by controlled cord traction, which

should not normally be attempted until there are signs of separation of the placenta if an oxytocic has been administered. Healthcare professionals should support women who want clamping delayed further.<sup>4</sup>

Umbilical cord milking recently emerged as an alternative to DCC, in some children at least. Further studies are needed. However, studies of umbilical cord milking support the importance of ensuring infants receive blood in the minutes immediately after birth. Umbilical cord milking may improve blood volume more effectively than DCC in premature infants delivered by caesarean section.<sup>5</sup>

DCC is not yet standard practice in many centres, partly due to concerns about an increased risk of polycythaemia and jaundice. However, none of the randomised controlled trials published since 1980 support a link between DCC and symptomatic polycythaemia or hyperbilirubinemia.<sup>3</sup> Nevertheless, treatment for jaundice requiring phototherapy should be available.<sup>6</sup> In addition, a mobile neonatal resuscitation trolley has been developed that allows the assessment and resuscitation of newborn babies alongside their mothers with, or without, an intact cord.<sup>7</sup>

DCC seems to facilitate breastfeeding, partly by countering the cognitive and physiological consequences of hypovolaemia. Placing the baby immediately on the mother’s abdomen while waiting to clamp the cord promotes skin-to-skin contact. This, in turn, potentially enhances mother-baby bonding, helps regulate neonatal temperature and heart rate,<sup>8</sup> and encourages breast feeding. Tactile stimulation of neonates and infants generally seems to improve growth and encourage social, cognitive and motor development.<sup>9</sup>

Despite guidelines from leading organisations and increasing clinical evidence, some centres have been very slow to implement DCC. Part of the problem is that definitions of DCC differ, underscoring the need for prospective studies using a standardised definition. There is clearly a need for midwives and other healthcare professionals to help embed best practice about cord clamping for every mother who gives birth.

## Introduction

The umbilical cord continues to pulsate for several minutes following delivery,<sup>1</sup> which propels cord blood into the infant. Increasing evidence suggests that the transfer of blood during this time is essential for the infant's acute and long-term well-being and that immediate cord clamping is associated with poorer outcomes compared to waiting for a few minutes before applying the clamp.<sup>3,6</sup>

As a result, numerous guidelines - including those published by the National Institute for Health and Care Excellence (NICE)<sup>4</sup> and the World Health Organization (WHO)<sup>2</sup> - recommend delayed (sometimes called "deferred" or "late") cord clamping (DCC) for most births. This Clinical Review examines the basis for these recommendations and outlines some areas for future research.

## The biological importance of delayed cord clamping

A newborn receives a considerable amount of its blood volume immediately after birth rather than in utero. Early cord clamping generally refers to clamping in the first 60 seconds after birth and usually within the first 15–30 seconds. DCC cord clamping is usually performed at least a minute after the birth or once the umbilical cord ceases to pulsate.<sup>2</sup> As a result, immediate cord clamping can cause neonatal hypovolaemia. Indeed, DCC increases neonatal blood volume by up to 30% for children born at term and by 50% for preterm infants compared with immediate (sometimes called early, "immediate" or "premature") cord clamping.<sup>3</sup> As Hutchon remarks, "in any other situation, losing 40% of circulating blood volume would lead to serious hypovolaemia and possible death".<sup>1</sup>

Not surprisingly, DCC is associated with a wide range of benefits for the neonate including:

- Improved systemic blood pressure.
- Improved cerebral oxygen perfusion.
- Reduced need for blood transfusions and support with drugs that increase the contractility of the heart (inotropic support).
- Lower risk of necrotising enterocolitis.
- Less risk of intracranial haemorrhage.

Indeed, DCC reduces the risk of intracranial haemorrhage almost two-fold.<sup>3</sup>

Moreover, a Cochrane review estimated, based on 12 studies encompassing 3139 infants, that birthweight was a mean 101g higher in infants managed with DCC compared with the early clamping group, a statistically significant difference. Haemoglobin concentrations 24 to 48 hours after birth were significantly lower (by a mean of 1.49g/dl) in the early cord clamping group, based on 844 children.<sup>6</sup>



Against this background, the WHO recommends DCC, not earlier than 1 minute after birth, "for improved maternal and infant health and nutrition outcomes".<sup>2</sup> A Cochrane review concluded that "a more liberal approach" to DCC in healthy term infants "appears to be warranted".<sup>6</sup>

Children who receive DCC also behave and look different to those managed with immediate cord clamping. For instance, a DCC child seems to be more alert and relaxed, and looks around more.<sup>8</sup> While a newborn's visual acuity is only about 1/40<sup>th</sup> of an adult's, neonates can process complex visual information. For example, babies prefer 'attractive faces' and are already 'sensitive' to the presence of eyes and eye contact.<sup>10</sup>

DCC seems to reduce the likelihood of distressed crying and breathing, possibly reflecting physiological changes arising from

the increased blood volume. For instance, the increased blood volume associated with DCC helps to fill the neonatal pulmonary circulation, thereby facilitating a gradual transition from placental oxygen supply to pulmonary respiration.<sup>8</sup> Early cord clamping can force the neonate to rely prematurely on the pulmonary system, which might pose a particular problem for neonates who do not breathe spontaneously.<sup>3</sup>

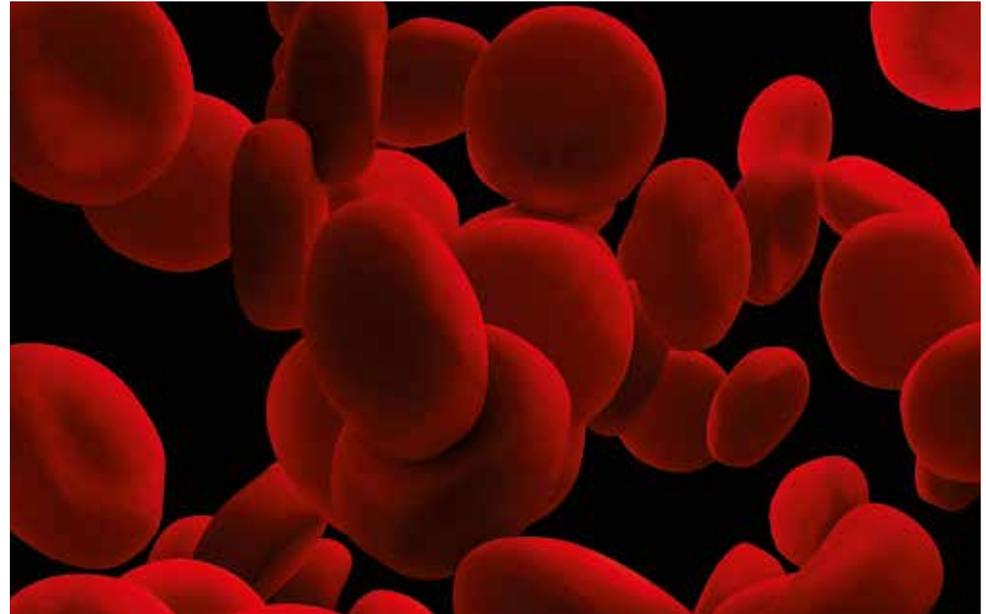
DCC's respiratory benefits are especially marked in premature babies. Indeed, ensuring adequate blood volume until pulmonary blood flow becomes established can aid resuscitation.<sup>3</sup> Furthermore, delaying cord clamping by between 30 and 120 seconds reduced the number of preterm babies who required transfusions for anaemia, improved circulatory stability as well as a reduced risk of intraventricular haemorrhage, necrotising enterocolitis and late-onset sepsis.<sup>8</sup>

## Long-term outcomes

Emerging data also suggests that DCC improves long-term outcomes compared with early clamping. For instance, among infants born at term, DCC seems to be associated with up to a 60% increase in red blood cells, higher haemoglobin levels at 24 to 48 hours of age, and increased serum ferritin levels at 4 to 6 months. Indeed, infants whose cords were clamped and cut early were twice as likely to be iron deficient at 3 to 6 months compared with DCC infants.<sup>3</sup> The Cochrane review concluded that infants in the early cord clamping group were 2.65 times more likely to be iron deficient at three to six months compared with DCC infants based on five trials involving 1152 infants.<sup>6</sup> DCC also seems to protect very low birth weight male infants against motor disability at 7 months of age (corrected age).<sup>1</sup>

Indeed, time to cord clamping may affect the child's neurodevelopment. The authors of one study defined DCC as clamping at least 180 seconds following delivery and early as clamping 10 seconds or less after delivery. At four years of age, the time to cord clamping did not seem to influence scores on the Wechsler Preschool and Primary Scale of Intelligence.<sup>11</sup>

However, DCC improved scores on the Ages and Stages Questionnaire (ASQ) personal-social and fine-motor domains as well as the Strengths and Difficulties Questionnaire prosocial subscale. Compared to early cord clamping, fewer children managed with DCC showed scores below the normal range in the ASQ fine-motor domain (11.0% and 3.7% respectively) and the Movement Assessment Battery for Children bicycle-trail task (12.9% and 3.8% respectively). The study shows that delaying cord clamping for at least 3 minutes after delivery is associated



with better fine-motor function in 4-year-old children than early clamping. However, DCC did not seem to influence full-scale IQ or behavioural difficulties.<sup>11</sup>

In addition, cord blood is a rich source of stem cells. These stem cells seem to be critical to ensure normal development of the central nervous, respiratory, cardiovascular, haematological, immunological and endocrine systems. The concentration of stem cells in cord blood is even higher in premature babies than in those born at term.<sup>3</sup>

In theory at least, loss of cord stem cells at birth could adversely influence the development of these systems. This, in turn, could predispose infants to conditions such as chronic lung disease, asthma, diabetes, epilepsy, cerebral palsy, Parkinson's disease, infection and malignancies.<sup>3</sup> The growing trend to collect

and store cord stem cells in case of future need requires further investigation to ensure that the practice is not detrimental to the infant's long-term health.

## Is delayed cord clamping harmful?

Theoretical concerns over polycythaemia and jaundice associated with the placental transfer of larger quantities of blood might have hindered implementation of DCC in some centres. However, neonatal polycythaemia and jaundice usually seem to be pathological rather than being associated with the time of cord clamping. Indeed, none of the randomized controlled trials published since 1980 support a link between DCC and symptomatic polycythaemia or hyperbilirubinemia.<sup>3</sup>

Nevertheless, the Cochrane review concluded that the proportion of infants that required phototherapy for jaundice was 38% lower in the early cord clamping group compared with DCC, based on seven studies that included 2324 children.<sup>6</sup> The Cochrane review concluded that treatment for jaundice requiring phototherapy should be available.<sup>6</sup>

The need for resuscitation does not necessarily influence the time of cord clamping. For example, a mobile neonatal resuscitation trolley allows the assessment and resuscitation of newborn babies alongside their mothers with, or without, an intact cord.<sup>7</sup> The mother can touch and speak to her newborn baby while it is undergoing assessment, and anecdotally parents reported they were pleased that the baby was so close to them and appreciated being able to witness airway management including intubation.<sup>12</sup> Further studies are on going.

NICE recommends that healthcare professionals do not clamp the cord earlier than 1 minute from the birth of the baby unless there is a concern, such as about cord integrity or the baby's heartbeat is below 60 beats per minute and is not getting faster. Healthcare professionals should clamp the cord between 1 and 5 minutes after birth followed by controlled cord traction, which should not normally be attempted until there are signs of separation of the placenta if an oxytocic has been administered. Healthcare professionals should support women who want clamping delayed further.<sup>4</sup>

### Umbilical cord milking

Umbilical cord milking may offer another approach to ensure children receive the benefits of cord blood. Essentially, during umbilical cord milking a healthcare professional grasps the unclamped umbilical cord and pushes the blood several times toward the infant over, for example, about 20 seconds. Studies investigating umbilical cord milking support the importance of ensuring infants receive cord blood immediately after delivery. Indeed, umbilical cord milking may improve blood volume more effectively than DCC in premature infants who are delivered by caesarean section.<sup>5</sup>

Most preterm infants are born by caesarean section. However, placental transfusion may be less effective after a caesarean section than following vaginal delivery. This difference resulted in researchers exploring umbilical cord milking as a means to deliver more cord blood to premature children.

For instance, one study enrolled 154 infants delivered by caesarean section and 43 infants delivered vaginally at a mean gestational age of 28 weeks. The infants were randomly assigned to umbilical cord milking (four strippings) or DCC (45–60 seconds). Of the infants delivered by caesarean, umbilical cord milking improved blood flow through the superior vena cava and right ventricular output during the first 12 hours of life compared to DCC. Haemoglobin, delivery room temperature, blood pressure over the first 15 hours and urine output in the first 24 hours were all higher in the umbilical cord milking group. There were no differences between umbilical cord milking and DCC for haemoglobin or superior vena cava flow among infants delivered vaginally.<sup>5</sup> Further studies are needed to identify fully the place of umbilical cord milking in practice, especially as the delay to cord clamping was shorter in this study than currently recommended by NICE.

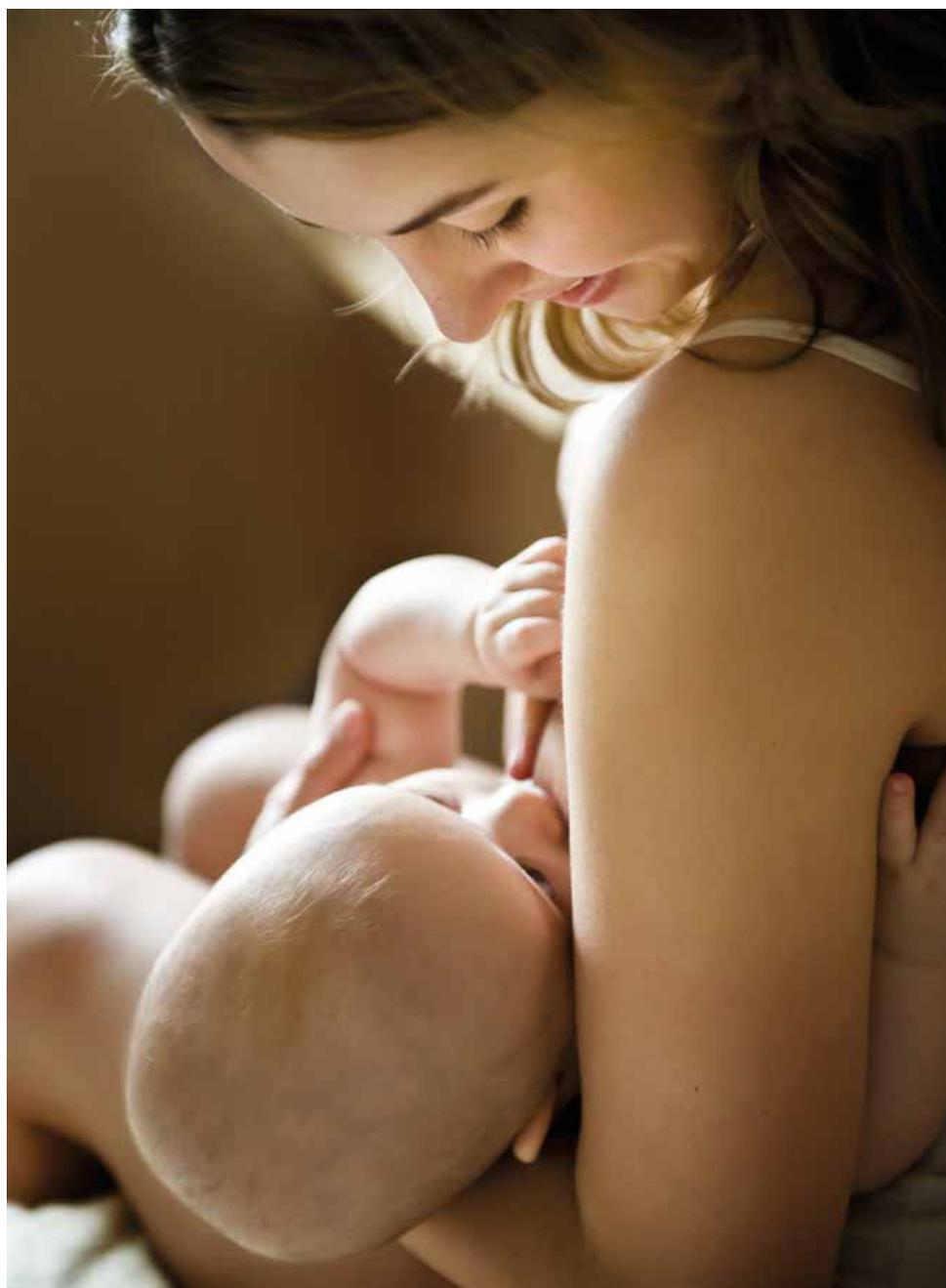
### The impact on breastfeeding

DCC also seems to facilitate breastfeeding, partly by countering the cognitive and physiological consequences of hypovolaemia. In addition, placing the baby immediately on the mother's abdomen during the delay to cord clamping promotes skin-to-skin contact. This, in turn, enhances mother-baby bonding, helps regulate neonatal temperature and heart rate,<sup>8</sup> and encourages breastfeeding.

Tactile stimulation of infants and young children generally seems to improve growth and encourage social, cognitive and motor development<sup>9</sup> as well as forge the bond between mother and baby. Indeed, psychologist Bruce Hood notes that "just

about every capability of the newborn's senses seems to be tuned in to their mums". Babies very quickly learn to recognise their mother's face and prefer their mother's voice to that of other people.

In conclusion, growing evidence suggests that DCC is associated with a range of improved outcomes for the neonate. Yet despite guidelines from leading organisations and overwhelming clinical evidence, some centres have been very slow at adopting DCC. Part of the problem is that definitions of DCC differ. Nevertheless, there is clearly a need for midwives and other healthcare professionals to help embed best practice regarding cord clamping for every mother who gives birth.



## LEARNING POINTS

- Normally, the umbilical cord continues to pulsate for several minutes after birth,<sup>1</sup> which continues to propel blood into the infant. As a result, DCC increases blood volume by up to 30% for children born at term and by 50% for preterm infants compared to immediate cord clamping.<sup>3</sup>
- DCC improves systemic blood pressure and cerebral oxygen perfusion; reduces the need for blood transfusions and inotropic support; and lowers the risk of necrotizing enterocolitis and intracranial haemorrhage.<sup>3</sup>
- Emerging evidence suggests that DCC improves long-term outcomes, including iron deficiency,<sup>3</sup> motor disability in some children<sup>1</sup> and conditions putatively associated with stem cell deficits, although further studies are needed.
- NICE recommends that, in general, healthcare professionals should not clamp the cord earlier than one minute from the birth of the baby unless there is a concern. The cord should be clamped between 1 and 5 minutes after birth followed by controlled cord traction. Healthcare professionals should support women who want clamping delayed further.<sup>4</sup>
- None of the randomised controlled trials published since 1980 support a link between DCC and symptomatic polycythaemia or hyperbilirubinemia.<sup>3</sup> However, treatment for jaundice requiring phototherapy should be available.<sup>6</sup>
- DCC seems to improve breastfeeding, partly by countering the cognitive and physiological consequences of hypovolaemia and encouraging skin-to-skin contact.
- Placing the baby immediately on the mother's abdomen while awaiting clamping, promotes skin-to-skin contact. In turn, skin-to-skin contact enhances mother-baby bonding, helps regulate neonatal temperature and heart rate,<sup>8</sup> and encourages breast feeding. Tactile stimulation generally seems to improve growth and encourage social, cognitive and motor development.<sup>9</sup>

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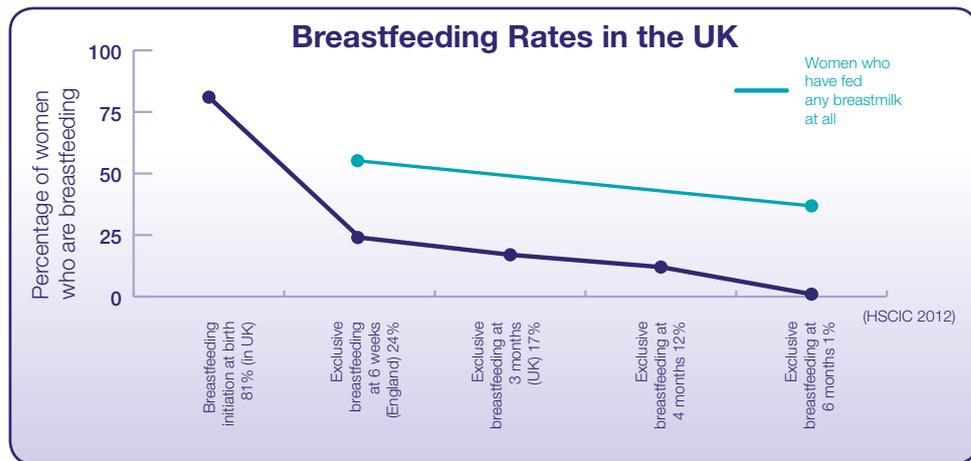
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