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Delayed umbilical cord clamping: A state of the science

Landynn E. Ouellette
James Madison University

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Delayed Umbilical Cord Clamping: A State of the Science

An Honors Program Project Presented to
the Faculty of the School of Nursing
James Madison University

by Landynn Ouellette

Accepted by the faculty of the School of Nursing, James Madison University, in partial fulfillment of the requirements for the Honors Program.

FACULTY COMMITTEE:

Project Advisor: Jagiello, Karen

Reader: Annan, Sandra

Reader: Scheikl, Marjorie

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Introduction

The concept of delayed umbilical cord clamping (DUCC) following birth has been debated for centuries with best possible timing for the health of newborns and their mothers yet to be determined. No protocol exists in health care for the most evidence-based cord clamp timing. The actual clamping and cutting of the umbilical cord immediately after birth was not widely practiced until the 1700's, though there were warnings then regarding the possible health ramifications of this practice (Downey & Bewley, 2012). In 1801, a physician named Erasmus Darwin wrote, "Another thing very injurious to the child is the tying of the navel string too soon; which should always be left till the child has not only repeatedly breathed, but till all pulsation in the cord ceases. As otherwise the child is much weaker than it ought to be" (Darwin, 1801). This quote illustrates this concept of DUCC and the history behind the debate. Delayed umbilical cord clamping is described as prolonging clamping of the umbilical cord until 30 to 60 seconds following delivery of the newborn. Benefits to delaying the clamping of the umbilical cord all stem from the increased blood supply provided to the newborn through the cord (Committee on Obstetric Practice, 2014; Linderkamp, Nelle, Kraus, Zilow, 1992). However, research has raised concerns regarding this increase in blood supply in respect to an increased risk for conditions such as polycythemia in these newborns (Committee on Obstetric Practice, 2014; Linderkamp et al., 1992). Positive and negative outcomes are becoming better known within the medical community and the need for an evidence-based, optimal cord clamping time is growing. Consistency in obstetric practice within the scope of DUCC is nonexistent and therefore, the best possible care is not being

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provided to all patients. Positive and negative outcomes for both the preterm and term newborn and the mother will be investigated in the form of a literature review with potential interventions to follow.

Review of Literature

This review of literature was completed in order to further examine the matter of inconsistent care of newborns and mothers in the capacity of the timing of umbilical cord clamping. A search of the literature published through PubMed was conducted using the key phrases delayed umbilical cord clamping, benefits of delayed cord clamping, and umbilical cord protocols. The search yielded 133 titles, which was limited to peer-reviewed, full-text research articles between the years 2011 to January 2016. After reading through the articles, another 100 were excluded because they did not include extensive information regarding the benefits of DUCC and/or management strategies for future policy development with 33 remaining for inclusion in this review. The following section consists of the positive outcomes of delayed cord clamping for newborns and mothers found in research.

Review of Literature: Positive Outcomes

A practice guideline produced by the World Health Organization (WHO), reports that DUCC can result in a decreased risk in preterm newborns for necrotizing enterocolitis and intraventricular hemorrhage, a 39% decreased need for blood transfusions, and a decrease the likelihood of iron deficiency (Rabe, Diaz-Rossello, Duley, Dowswell, 2012; World Health Organization [WHO], 2014). There was no risk for polycythemia with delayed clamping found in the group of term newborns in which this research was based. The benefits associated with DUCC outweigh any possible harm

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from the increase in blood supply from a human deficiency virus (HIV) unknown or positive mother (Rabe et al., 2012; WHO, 2014). Therefore it is recommended that newborns of HIV unknown or positive mothers should have DUCC due to the benefits for the newborn's blood supply and the stem cell influx. In a study mentioned by WHO, early cord clamping has been classified as taking place before 15 seconds and delayed cord clamping as taking place between 30 and 180 seconds (Rabe et al., 2012; WHO, 2014). There were no clinically significant differences in hemorrhage for the mothers. However, it was found that by delaying the clamping and therefore, allowing more blood to leave the placenta, there may be a decreased risk for a retained placenta and resulting complications in the mother (Rabe et al., 2012; WHO, 2014).

The Committee on Obstetric Practice's (2012) article illustrates that in the first minute of a newborn's life, 80 mL of blood can transfer to the newborn through the placenta. Then, by three minutes of life, the newborn can receive 100 mL of blood from the placenta. The iron contained in this blood, in addition to the iron already present in the newborn's body, can diminish the newborn's risk for iron deficiency during the first year of life (Committee on Obstetric Practice, 2012). This extra blood can also decrease a preterm newborn's need for a blood transfusion, for suffering from an intracranial hemorrhage, and developing iron deficiency anemia. Researchers believe that the immunoglobulin and stem cells found in the placental blood may enhance a preterm newborn's ability to rebuild and repair organs that are damaged from birth (Committee on Obstetric Practice, 2012; Rabe et al., 2012). It is stated that there needs to be further research on the effects of DUCC on the mother's risk for hemorrhage due to the 600 mL

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per minute of blood that travels through the spiral arteries and veins in a uterus that reaches a term pregnancy (Committee on Obstetric Practice, 2012).

In addition to the short term benefits of DUCC to newborns, the stem cells provided to newborns through placental transfer has the potential to diminish future risk of age-related disorders (Lee, et al., 2007; Sanberg, Divers, Mehindru, Mehindru, & Borlongan, 2014). Due to the effect that stem cells have on the development and maturity of organ systems, the authors believe that this influx of cells in newborns can prevent organ system disorders such as Parkinson's disease, myocardial infarction, stroke, Huntington's disease, osteoporosis, and Alzheimer's disease (Lee, et al., 2007; Sanberg, et al., 2014). By ensuring an increased supply of umbilical cord blood and therefore, stem cells, the newborn's future health and protection from disease can be greatly impacted. This noninvasive measure has the potential to lessen the degree of illness seen in society today by affecting humans when they first enter the world (Lee, et al., 2007; Sanberg et al., 2014).

Tarnow-Mordi et al. (2014) highlights that there are numerous short-term benefits to DUCC that are promising for several possible benefits in preterm newborns. These benefits that stem from the additional blood volume provided to the newborn can lead to added time for the newborn to initiate spontaneous breathing while still receiving blood from the mother through the cord, a smoother conversion to life outside of the uterus in terms of blood flow and respirations, less risk of necessary resuscitation, reduced risk of childhood anemia through additional iron stores, and added stem cells that produce anti-inflammatory, neurotrophic, and neuroprotective effects. It is emphasized that the most intriguing positive outcome of DUCC is a possible 50% reduction in risk of

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intraventricular hemorrhage in preterm newborns due to the decrease in disruption of the systemic vascular resistance that can occur with immediate cord clamping (Tarnow-Mordi et al., 2014).

The possibility of a decreased need for blood transfusions for anemia, a higher mean arterial blood pressure, a reduced need for inotropes, and a reduced risk of necrotizing enterocolitis in preterm newborns between 24 and 36 weeks' gestation has been found in newborn's with DUCC (Bhatt et al., 2013; Duley & Batey, 2013). Though it is stated that these findings are not definitive, they are encouraging of beneficial outcomes for preterm newborns with DUCC. For term newborns, it was found that those who were assigned to DUCC had higher hemoglobin than those with immediate cord clamping and therefore, had a diminished risk for iron deficiency for the next three to six months (Duley & Batey, 2013). It was also found that there is possibly no difference in a newborn's risk for polycythemia or decrease in body temperature when cord clamping is delayed. This research recommends that this practice of DUCC be practiced when there is an availability of bilirubin testing and phototherapy in case of hyperbilirubinemia (Duley & Batey, 2013). It is stated that in a recent study conducted with preterm lambs, it was found that DUCC can improve cardiovascular function. Lambs that were ventilated at birth while the umbilical cord clamping was delayed were compared with lambs that were ventilated after immediate clamping. The cardiovascular function of the lambs with DUCC was enhanced due to the secure hemodynamic transition with better pulmonary blood flow and more stable carotid artery pressure along with more steady carotid artery blood flow and heart rate (Bhatt et al., 2013; Duley and Batey, 2013).

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Research implies that hemoglobin concentration remains significantly higher in DUCC newborns following 24 hours after birth (Ceriani Cernadas et al., 2006; McDonald, Middleton, Dowswell, & Morris 2014). In addition, it is a possibility that increased iron stores in newborns with DUCC do remain three to six months following birth, which also supports the concept of a decreased risk for iron deficiency (Chaparro et al., 2007; McDonald et al., 2014). The following section consists of the negative outcomes of delayed cord clamping for newborns found in research.

Review of Literature: Negative Outcomes

In research, the main clinically significant evidence of a negative consequence associated with DUCC is a higher peak level of bilirubin found in newborns with DUCC (WHO, 2014). Tarnow-Mordi et al. (2014) state hypothermia may occur in preterm newborns as a possible result of delayed cord clamping, however, the long-term effects of both hypothermia and jaundice are unknown with current research. WHO (2014) states that there are few instances in which DUCC should be avoided. One instance in particular that requires early cord clamping prior to 60 seconds after birth is that which entails resuscitation of the newborn. When immediate resuscitation of a newborn is required due to asphyxiation, it is indicated for the umbilical cord to be clamped and cut so that the newborn can be appropriately and instantly cared for (WHO, 2014). The following section consists of management strategies found in research concerning the future of bringing consistency to umbilical cord clamping.

Management Strategies

With the significant amount of benefits that newborns and their mothers can experience in comparison to the little risk associated with DUCC, it is necessary that

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further research be completed in order for a reliable protocol in the timing of umbilical cord clamping to be created. With a universal protocol in place, each baby delivered by a physician or nurse midwife, with the exception of newborns in need of immediate resuscitation, has the opportunity to experience better health outcomes both at birth and later in life. Without a protocol, there is the potential for physicians and nurse midwives to clamp the umbilical cord at an undesirable time due to a lack of agreement and knowledge, which could impact the well being of newborns as they begin their lives.

In regard to the numerous potential benefits that can be reaped by newborns and mothers with the delayed clamping of umbilical cords, several strategies for the development of a universal protocol can be established and chosen based on research and evidence. Since it seems as though a universal protocol may be difficult to accomplish in a less lengthy period of time, an *International Journal of Obstetrics & Gynecology* article, written by Sivaraman and Arulkumaran (2011), stated that raising awareness of these benefits with obstetricians has the potential to cause change through education prior to a change in policy. In addition to raising awareness about research-based evidence, it would also be best to continue research as further support for a protocol implementation. In result, a policy change would likely be more successful with better outcomes for the newborns and mothers (Sivaraman & Arulkumaran, 2011).

WHO (2014) recommends that as a global guideline is established, each Member State should follow recommendations to the greatest extent that is possible by keeping in mind restrictions and values that are applicable to each area. It would be up to each Member State to ensure the adequate education of health care facilities, while each facility ensures the preparedness of its health care team. This strategy has the potential to

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increase compliance by health care professionals, as they better understand the need for DUCC for their patients (WHO, 2014). A successful story of a past policy implementation occurred in the Peruvian Amazon in which the delayed clamping of umbilical cords increased from 39.3% to 85.7% following this intervention. The only improvement that WHO recommends be made in the future is the observance of practitioners by the hospital research team in order to increase compliance (WHO, 2014).

It is recommended by the Committee on Obstetric Practice (2012) that more research be done prior to a change in protocol. Specifically, research on the appropriate time to clamp umbilical cords in cesarean deliveries in comparison to vaginal deliveries is recommended (Committee on Obstetric Practice, 2012). This strategy would be necessary prior to policy change due to the percentage of women who deliver by a cesarean section and the need to include all mothers in a universal protocol (Committee on Obstetric Practice, 2012).

Tarnow-Mordi et al. (2014) recommends that future research be done globally and that thousands of subjects be involved, in comparison to hundreds of subjects in past studies, so that more reliable evidence is available for practice. This article also uniquely suggests that government funding be advocated for and utilized in this research. It is possible that tax money typically spent on medical occurrences such as intraventricular hemorrhage in preterm newborns could be reduced and therefore, the research could essentially pay for itself by saving future medical expenses (Tarnow-Mordi et al., 2014). Duley and Batey (2013) recommend that more comparative research be completed with newborns requiring resuscitation and with newborns ranging from very preterm to term. Similar to other articles, their research also implores scholars to research the effects of

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the timing of umbilical cord clamping on children as they age in terms of developmental and physical differences (Duley & Batey, 2013).

McDonald et al. (2014) state that more research should be implemented that considers postpartum hemorrhage specifically in women who participate in delayed versus early umbilical cord clamping. In the past, it was believed that immediate cord clamping in addition to umbilical cord traction in the third stage of labor reduced the risk for postpartum hemorrhage because this stage was shortened in time (McDonald et al. 2014). However, it is not typically practiced due to a lack of evidence. Therefore, the effect of DUCC on postpartum hemorrhage is a topic of uncertainty that requires definitive research (McDonald et al., 2014).

Recommendations and Summary

Further research is necessary prior to the creation or recommendation of any protocol regarding the timing of umbilical cord clamping. The most appropriate way to integrate this research into practice would be to begin by educating and raising the awareness of health care professionals themselves. This can begin prior to the determination of the best possible timing so that conversations amongst the health care team can be initiated. This way, the educated obstetricians and nurse midwives can choose to integrate DUCC into their practice prior to an official universal protocol if they choose to based on what research is currently showing. Patients could then possibly benefit sooner than is possible if awaiting a change in policy. With further research and involvement of health care professionals, this noninvasive approach to health improvement can be fully understood before a universal protocol. In addition to educating health care professionals, I believe that patients themselves should also be

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educated about current research on the optimal timing for umbilical cord clamping in order to prepare for discussions with their own health care providers. It is important to remember that patients are also members of the health care team and should be involved in the development of their own health care plan.

Following education, awareness, and research, protocol should be changed in the health care setting in a way that focuses on better patient outcomes while respecting health care providers' past practices. By respecting providers' past practices, they may be more likely to incorporate new, evidence based practice into their care. This can be done by recognizing the concerns voiced by providers and by focusing on clarification of the need for change. Approaching this health care change from multiple angles can increase the likelihood of a successful implementation, which is vital for the potential health improvements in newborns and mothers in society. Though delaying cord clamping is a simple concept, the effects that are possible in the future health of the population may be pronounced with the appropriate approach.

Based on my literature review of the positive and negative consequences of delayed umbilical cord clamping, there is vitality in establishing a universal protocol that generates consistency in obstetric practice. Consistency in practice has the potential for better patient outcomes because the same level of education on the topic of umbilical cord clamping would be provided to health care systems and professionals in all socioeconomic structures. Newborns and mothers from all backgrounds would be provided with similar care and short and long-term outcomes could improve for all patients.

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