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Delayed Clamping of the Umbilical Cord: A Review with Implications for Practice

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Abstract and Introduction

Abstract

S.N., a healthy 22-year-old gravida 2 para 1 at 38 2/7 weeks' gestation, was admitted to the hospital in active labor. Her history and prenatal course were uncomplicated. Contractions began 10 hours before her arrival at the hospital. Her vaginal examination on arrival was 5 cm dilatation, 50% effaced, and -2 station of the vertex, with intact membranes. Her contractions were occurring every 3 to 5 minutes. Shortly after hospital admission, epidural analgesia was initiated at the patient's request. Four hours later, the frequency of her contractions was every 4 to 6 minutes, and a pelvic examination revealed minimal progress at 6 cm dilatation, 80% effacement, and -1 station. In an attempt to increase the frequency of her contractions, an amniotomy was performed and oxytocin augmentation was initiated. An hour later, her contractions were occurring every 3 to 4 minutes, lasting 60 to 90 seconds. Three hours later, she was fully dilated and the baby's head was at +1 station in an occiput anterior position. At this point, she was instructed to begin pushing with each contraction. Twenty minutes later, S.N. gave birth via normal spontaneous vaginal delivery to a healthy baby boy. The umbilical cord was clamped within 30 seconds of birth, which is routine practice at this hospital, and the baby was brought directly to the warmer. There was no previous discussion with S.N. concerning the timing of the umbilical cord clamping. The placenta spontaneously delivered 5 minutes later, at which point routine oxytocin infusion was initiated via intravenous infusion. The baby boy weighed 3075 g and had Apgar scores of 9 and 9, at 1 and 5 minutes, respectively. There were no labial or perineal lacerations, nor excessive bleeding. The mother's blood type was Rh-positive. Breastfeeding was not attempted in the immediate postpartum period because of maternal exhaustion. Postpartum day one, the baby was both bottle-feeding with formula and breastfeeding. The baby's newborn examination and laboratory values were within normal limits. The family left the hospital on the second postpartum day, satisfied and doing well.

Introduction

Cord clamping immediately after birth is a routine obstetric procedure in the United States[1,2] despite a dearth of supportive evidence documenting its benefits. The case described here represents a common scenario in US hospitals, where discussion of the timing of cord clamping is rare. Currently, there is no set practice guideline for practitioners that delineates when this action should be taken. Active management of the third stage of labor—the objective of which is to reduce the risk of postpartum hemorrhage—often includes clamping the umbilical cord within 30 seconds of birth.[3] Several theories about the potential benefits and risks of delaying the clamping of the umbilical cord have been postulated and studied in recent years. This article reviews the benefits of delayed cord clamping, specifically increased hemoglobin (Hgb) and hematocrit (Hct) levels for the neonate with a subsequent reduction in rates of anemia and iron deficiency that may extend into the infant period. We then analyze the potential dangers of delaying cord clamping (i.e., increased rates of pathologic jaundice, polycythemia, and transient tachypnea in the neonate or increased rates of maternal postpartum hemorrhage). We also take into consideration populations for whom delayed cord clamping could provide extra benefit, such as preterm infants and babies born in areas where anemia is endemic.

Between 25% and 60% of the total fetoplacental circulating blood volume is found in the placenta at term.[2,4] Allowing placental transfusion after birth can provide the newborn with a 30% increase in blood volume and up to a 60% increase in red blood cells (RBCs).[5] This physiologic transfusion is, on average, between 19 and 40 mL/kg of birth weight, equivalent to as much as 2% of the newborn's final birth weight.[1,4]

Definition of Delayed Cord Clamping

There is currently no set definition of "delayed" cord clamping and clamping times vary significantly between studies. Table 1 shows the wide range of parameters used when discussing delayed clamping. Rabe et al.'s [6] Cochrane metaanalysis defined delayed clamping as a delay of 30 seconds or more after birth. Van Rheenen et al.'s[7] randomized controlled trial (RCT) comparing delayed versus immediate cord clamping in term infants recommended waiting 3 minutes before clamping, unless the state of the infant required earlier intervention, in which case the recommendation is to wait 60 seconds with the infant between the mother's legs. In a systematic review by Van Rheenen and Brabin,[8] delayed cord clamping was defined as waiting until the umbilical cord had stopped pulsing (mean clamping time was 305 sec). In an RCT looking at the effect of the timing of cord clamping on neonatal venous Hct by Cernadas,[9] there were 2 different "delayed" groups—one group clamped at 1 minute and the other at 3 minutes.

Table 1. Studies on Early Versus Late Cord Clamping

Author, Year	Study Population	Cord Management	Statistically Significant Results	Recommendations
Strauss et al.,[13] 2008	Partially blind RCT, < 36 wks EGA; early, n = 60; delayed, n = 45	Early = within 15 sec; delayed = 1 min	Circulating RBC vol/ mass increased and Hct values were higher after delayed clamping	1 min delay in infants 30–36 wks EGA who do not need resuscitation
Hutton and Hassan,[2] 2007	15 RCTs, full-term infants	Early = immediately after birth; delayed = minimum of 2 min	Improved hematologic status over 2–6 mos with delayed clamping	Minimum of 2-min delay
McDonald and Middleton,[3] 2008	11 RCTs, full-term infants	Early = within 60 sec; delayed = > 1 min after birth or when cord pulsation ceased	No difference in rates of PPH, increase in neonatal Hgb/Hct; increase in jaundice	A more "liberal" approach to delaying clamping in healthy term infants
Jahazi et al., [5] 2008	Healthy, full-term, vaginally born neonates; delayed, n = 34; early, n = 30	Early = 30 sec; delayed = 3 min	No increase in Hct noted; significantly increased ENBV	Potential benefit should be considered by providers

Utlee et al.,[12] 2007	RCT, 34–37 wks EGA; early, n = 19; late, n = 18	Early = < 30 sec; late = > 180 sec	Delayed groups had higher Hgb levels at 1 hr postpartum and 10 wks old; no difference in the ferritin levels at 10 wks	Immediate cord clamping should be discouraged
Van Rheenen et al.,[7] 2007	Delayed, n = 46; control, n = 45	Awaited cessation of pulse, mean clamping time 305 sec (control mean clamping time, 15 sec)	Increase in PCV, increased Hgb at 4 mos	3-min delay
Cernadas et al.,[9] 2006	Early, n = 90; delayed 1, n = 90; delayed 2, n = 92	Early = within 15 sec; delayed 1 = 1-min delay; delayed 2 = 3-min delay	Hct at 6 hrs highest in delayed cord clamping, lowest in early; increase in anemia at 6 hrs and 24–48 hrs in early	Delay of at least 1 min
Van Rheenen and Brabin,[8] 2006	Four RCTs	Immediate = within 20 sec; delayed = 30 sec to 2 min	Decreased anemia up to 4 mos, higher iron levels up to 6 mos	Delay of at least 3 min
Rabe and Diaz-Rossello,[6] 2004	Seven RCTs	Early = within 30 sec; delayed = 30–120 sec	Decreased IVH, fewer blood transfusions	Delay of 30–120 sec

EGA = estimated gestational age; ENBV = estimated neonatal blood volume; Hct = hematocrit; Hgb = hemoglobin; IVH = intraventricular hemorrhage; PCV = packed cell volume; PPH = postpartum hemorrhage; RBC = red blood cell; RCT = randomized controlled trial.

Although some studies and many midwives use the cessation of cord pulsing as a marker for when the cord should be clamped, there is no standard measure for this, either. It is unclear whether this means waiting until there is no pulse left at all or waiting for the pulse to become weak, which is both variable and subjective.

Benefits of Delayed Cord Clamping

Hemoglobin and Hematocrit Values

In term newborns, waiting 1 to 3 minutes after birth to clamp the umbilical cord has been shown to result in an increase in neonatal Hct and Hgb levels,[3,9] which results in a significantly lower proportion of infants with anemia.[8,9] In an RCT of term infants born to mothers without prenatal or obstetric complications, Cernadas et al.[9] compared the venous Hct of 276 newborns, allocated either to cord clamping at 15 seconds, 1 minute, or 3 minutes after birth. At 6 hours of life, Hct values were significantly lower in the infants allocated to the early clamping group versus the 1- and 3-minute groups (53.5%, 57%, and 59.4%, respectively.)[9] At

24 to 48 hours of life, the difference continued to be significant, with Hct levels of 51.4%, 53.62%, and 56.41% for the 15-second and 1- and 3-minute groups, respectively.

In a metaanalysis of 15 controlled trials of full-term infants (n = 1912), Hutton and Hassan[2] found that as early as 7 hours after birth, mean neonatal Hgb levels measured in capillary blood are higher in newborns with late clamping.[2] Neonatal Hct levels were significantly higher at 24 to 48 hours after birth when cord clamping was delayed for a minimum of 2 minutes.[2] Perhaps more importantly, this difference continued to be significant between 2 months after birth and 6 months after birth (weighted mean difference [WMD], 3.7%; 95% confidence interval [CI], 2.0%–5.4%). At 6 months, no difference remained between the two groups.

Similarly, three trials (n = 671) included in McDonald and Middleton's[3] Cochrane metaanalysis, found significantly lower infant Hgb levels at birth (WMD, -2.17; 95% CI, -4.06 to -0.28) and again at 24 hours in infants in early clamping groups (WMD, -1.34 g/dL; 95% CI, -1.88 to -0.88; 2 trials; n = 382). While McDonald and Middleton's[3] metaanalysis describes one trial in which a favorable effect was found in Hgb values at 2 to 4 months, there was no difference when all three trials in the review were combined.[3]

Ferritin Levels

When compared with early clamping, delayed cord clamping has been shown to significantly increase neonatal iron stores.[2,3] Hutton and Hassan[2] found that ferritin levels at 2 to 3 months of age were higher in infants allocated to late clamping versus early clamping (2 trials; n = 144; WMD, 17.89 mcg/L; 95% CI, 16.58–19.21) and estimated a 33% reduction in the risk of having deficient iron stores at that age. Two trials, with a total of 165 infants, found that fewer infants in the late clamping group had ferritin levels < 50 mg/L at 3 months of age (relative risk [RR], 0.67; 95% CI, 0.47–0.96).[2] One trial of 107 infants, included in McDonald and Middleton's[3] Cochrane metaanalysis, also showed ferritin levels were significantly higher in the late clamping group at age 3 months (WMD, 17.90 mcg/L; 95% CI, 16.59–19.21).[3] Interestingly, at 6 months in a different trial of 315 infants, ferritin levels continued to be significantly higher than those with early clamping (WMD, 11.80 mcg/L; 95% CI, 4.07–19.53). In this same trial, none of the infants in the late clamping groups versus six in the early clamping group were diagnosed with iron deficiency.[2]

Compared with immediate clamping, delaying cord clamping for 3 minutes provides an additional blood volume of approximately 20 mL/kg to the newborn.[7,9] This has been shown to provide an additional 40 to 50 mg/kg of iron and an increase in packed cell volume.[7,8,9] This is especially relevant when considering that iron deficiency is the primary cause of anemia which, early in life, can lead to marked central nervous system effects and cognitive impairment.[9] In addition, delayed cord clamping can increase the rate of transfer of hematopoietic stem cells to the newborn, which may play a role in the prevention of certain blood disorders and immune conditions[9] and a clinically significant reduction in anemia (RR, 0.53; 95% CI, 0.40–0.70).[2]

Anemia

Increased infant Hct and Hgb levels result in a reduced risk of anemia during infancy. In three separate trials, Hutton and Hassan[2] found that the risk of anemia (defined as a Hgb < 10 g/dL or Hct < 46%) was decreased with late clamping at 24 to 48 hours (RR, 0.20; 95% CI, 0.06–0.60; 1 trial; n = 179) and at 2 to 3 months (RR, 0.53; 95% CI, 0.4–0.7; 2 trials; n = 119). The authors estimated a significant 47% reduction in the risk of anemia when late clamping was employed.[2] Cernadas et al.[9] found that there were significantly more infants with a Hct level of < 45% from the 15-second clamping group than the 1-minute (RR, 0.13; 95% CI, 0.035–0.50) or 3-minute groups (RR, 0.20; 95% CI, 0.06–0.61). McDonald and Middleton's[3] Cochrane meta-analysis supports this finding. When defined as a Hct of < 45%, fewer infants in the late clamping group had anemia at 24 to 48 hours after birth.[2] At 6 months, this difference was no longer apparent.

Potential Adverse Effects of Delayed Cord Clamping

It has been postulated that delayed cord clamping may increase rates of hyperbilirubinemia, polycythemia, and transient tachypnea in the newborn or maternal hemorrhage. However, delayed cord clamping has never been proven to increase the rate of neonatal symptomatic disease or maternal blood loss.[3,6,9]

Polycythemia

Polycythemia is defined as a Hct level > 65% and occurs in about 2% to 5% of term newborns.[11] The primary concern with polycythemia is related to the development of blood hyperviscosity. The need for treatment of polycythemia is determined by elevated Hct levels along with the presence of symptoms. A partial exchange transfusion is used to treat newborns with a Hct over institutionally prescribed levels, which is usually = 65%.[11]

Data on the risks of developing polycythemia from delayed cord clamping are varied. In the metaanalysis by Hutton and Hassan,[2] the risk of developing polycythemia was slightly higher in neonates allocated to delayed cord clamping at both 7 hours after birth (RR, 3.44; 95% CI, 1.25–9.52; two trials; n = 236) and at 24 to 48 hours after birth (RR, 3.82; 95% CI, 1.11–13.21; 7 trials; n = 403). Most significant was the finding that none of the polycythemic infants were symptomatic or needed treatment. In a double blind RCT of 64 full-term infants, Jahazi et al.[5] found that no infant developed clinical manifestations of polycythemia at 2 hours, 18 hours, or 5 days after birth, but that 21.9% of the infants from both delayed and immediate clamping developed asymptomatic polycythemia at 2 hours of life. There were no significant differences between the two groups. McDonald and Middleton's[3] Cochrane metaanalysis found that there was no significant difference or increased risk for developing polycythemia when delayed cord clamping was performed (RR, 0.39; 95% CI, 0.12–1.27; n = 463).

Hyperbilirubinemia

The potential for developing hyperbilirubinemia is another issue of concern. In their systematic review, using data from 1009 infants, Hutton and Hassan[2] found no significant difference in mean serum bilirubin levels nor an increased risk of neonatal jaundice within the first 24 hours of life associated with late clamping (RR, 1.35; 95% CI, 1.00–1.81). One of their included studies reported a mean bilirubin level of 192.8 mmol/L in the late clamping group versus 175.7 mmol/L in the early clamping group. Another trial found a mean bilirubin of 99.18 mmol/L in the late clamping group and 104.31 mmol/L in the early clamping group.[2] They also report no significant difference between the groups in risk of jaundice at 3 to 14 days after birth nor in the percentage of infants with bilirubin levels exceeding 256.5 mmol/L (15 g/dL) requiring phototherapy (RR, 1.27; 95% CI, 0.76–2.10; 1 trial; n = 332).[2] Furthermore, using 3 RCTs (n = 111), Rabe et al. found that none of the neonates with elevated bilirubin levels required phototherapy treatment or exchange transfusions.[6]

McDonald and Middleton's[3] Cochrane metaanalysis found that the difference between early and late cord clamping for clinical jaundice did not reach statistical significance (RR, 0.83; 95% CI, 0.65–1.06; n = 1828). However, significantly fewer infants in the early cord clamping group required phototherapy for jaundice than in the late clamping group (RR, 0.59; 95% CI, 0.38–0.92; n = 1762). They report that 3% of infants in the early group and 5% of infants in the late group required therapy, a risk difference of 2%.[3]

Respiratory Distress

Transient tachypnea of the newborn may occur as a result of delayed absorption of lung fluid caused by an increase in blood volume related to delayed cord clamping. Although Cernadas et al.[9] found a slight increase in respiratory rate in those infants who experienced delayed cord clamping, no additional respiratory therapy was needed for these infants. McDonald and Middleton[3] found that both the delayed and immediate clamping groups had a similar number of infants admitted to any level of neonatal intensive care unit for respiratory distress (RR, 1.01; 95% CI, 0.18–5.75; n = 1008). Overall, the data concerning the relationship between respiratory distress and delayed cord clamping are inconclusive.

Maternal Hemorrhage

Immediate cord clamping is often included as part of active management of the third stage of labor. Although it is now well known that active management decreases the risk of postpartum hemorrhage, immediate cord clamping is not formally a component of active management and does not appear to aid in this risk reduction. McDonald and Middleton's[3] Cochrane review found no significant difference between early and late cord clamping groups with regard to = 500 mL blood loss (RR, 1.22; 95% CI, 0.96–1.55; n = 1878), mean maternal blood loss (WMD, 6.36 mL; 95% CI, -34.94–47.66; n = 963), maternal Hgb values at 24 to 72 hours after birth (WMD, -0.12 g/dL; 95% CI, -0.30–0.06; n = 1128), maternal need for blood transfusion (RR, 0.79; 95% CI, 0.20–3.15; n = 963), need for manual removal of the placenta (RR, 1.59; 95% CI, 0.78–3.26; n = 1515), instances of the third stage of labor lasting longer than 30 or 60 minutes (n = 963), or the need for the therapeutic administration of uterotonics (RR, 0.94; 95% CI, 0.74–1.20; n = 963).

Newborn Position

It has been suggested that the position of the newborn in relation to the placenta influences the amount of blood transfused. Van Rheenen et al.[7] and Van Rheenen and Brabin[8] recommend keeping the newborn between 10 cm above and 10 cm below the level of the placenta allowing for optimal transfusion within 3 minutes, while holding the newborn 40 cm below the placenta will shorten this time to1 minute. Levy and Blickstein[10] note that the infant may be placed at or below the level of the placenta to allow gravity to transfuse blood through the cord. Further research must be done on this topic in order to make a recommendation for the placement of the baby when delayed cord clamping is performed.

Special Considerations

Delayed Cord Clamping for Preterm Infants

Delayed cord clamping has been shown to be especially beneficial for preterm infants. In industrialized countries, 60% to 80% of preterm infants born before 32 weeks of gestation require blood transfusions.[6] Increases in Hgb levels and RBC volume are associated with a reduction in the need for blood transfusion, either for anemia or low blood pressure, in the first 6 weeks of life.[6,8] In addition, the risk of intraventricular hemorrhage, a significant cause of neonatal morbidity and mortality in premature infants, is reduced with the use of delayed cord clamping.[6] In an RCT of 37 premature infants at 34 to 37 weeks of gestation, Ultee et al.[12] found that infants with delayed cord clamping had significantly higher Hgb levels than those with immediate cord clamping (13.4 mmol/l [1.9], n = 19 versus 11.1 mmol/l [1.7], n = 18) at 1 hour postpartum and continued to have higher Hgb levels up to 10 weeks of age (6.7 mmol/l [0.75], n = 19 versus 6.0 mmol/l [0.65], n = 18).[12] Interestingly, there was no difference between the groups in ferritin levels at 10 weeks.

Ultee et al.[12] found no difference between the delayed and immediate groups in terms of mean glucose levels and the number of infants born with a blood glucose of < 2.0 mmol/l.

Strauss et al.[13] found that circulating RBC volume/mass increased after delayed cord clamping (74.4 mL/kg) versus immediate cord clamping (62.7 mL/kg) in preterm infants. Interestingly, the increase in RBC volume/mass was not observed immediately in the neonates with delayed cord clamping, but it lead to significantly higher Hct levels by day 7 that continued throughout the first 28 days of life.

Delayed Cord Clamping in Developing Countries

Delayed cord clamping may be particularly beneficial to newborns in developing countries and resource-poor environments because it is a safe and inexpensive way to prevent infant anemia.[8] Particularly in countries where severe anemia of the mother and newborn is common, and in countries where blood transfusions are not readily available, delayed cord clamping should be considered for all infants regardless of gestational age. Perhaps in these settings, using gravity for added blood transfusion after the cord has stopped pulsing would be particularly beneficial in order to ensure the maximum amount of placental blood is reaching the newborn.

Lotus Birth

Lotus birth or "umbilical nonseverance" is a practice where the umbilical cord is never cut from the placenta. Many cultures around the world view the placenta with high spiritual regard, and the practice is based on the belief that allowing the baby to stay attached to the placenta is both nonviolent and allows for an easier transition into life for the newborn.[14] The placenta is cleaned and covered with a mixture of salts and herbs and wrapped in a cloth until it naturally disintegrates in about 3 to 7 days.[14] It is more difficult to pass the baby around, therefore decreasing exposure to infection. We could find no scientific studies evaluating the benefits of this practice.

Cord Blood Banking

Cord blood banking may conflict with practicing delayed cord clamping because blood banking facilities require a substantial amount of umbilical blood to ensure proper stem cell harvesting.[10] In a conversation with two reputable cord blood banking companies, Viacord and CBR, no recommendations were given concerning the number of units of cord blood needed for adequate banking.[15] In order to collect 100 million stem cells, which is the minimum amount of cells needed for transplant, both Viacord and CBR recommend that practitioners immediately clamp the cord. Neither company was opposed to delayed cord clamping but explained that delayed cord clamping may lower the stem cell count leaving it unusable (personal communication; Fred Foster at Viacord and Fred Ganzales at CBR, October 27, 2008). Because immediate cord clamping will decrease the amount of blood transfused to the newborn, increasing the baby's chances of developing anemia, it is important that midwives and parents evaluate the needs of the newborn when deciding to bank cord blood.[10]

Implications for Clinical Practice

The practice of delayed cord clamping has shown many benefits to the newborn with no documentation of significant risk. As such, it is incumbent upon clinicians to educate their clients about the physiologic impact of the practice of delayed cord clamping and to involve women in this decision, as we do in so many other clinical scenarios. In the case described at the beginning of this article, S.N. had not been counseled prenatally regarding the options for cord clamping, nor was she involved in the decision after her birth.

There are currently no formal clinical guidelines for the timing of umbilical cord clamping.[15] Therefore, the amount of time between birth and cord clamping is a decision made by the individual provider based largely on personal preference. It is essential for midwives and other obstetric providers to establish a clear definition of delayed cord clamping, along with a set of clinical guidelines. Likewise, further research should be done on delayed cord clamping and its impact on both breastfeeding and bonding. An intact umbilical cord inherently necessitates physical closeness between the mother and baby and can therefore aid in immediate bonding by disallowing separation. As professionals, we need to be open and eager to participate in carefully designed studies that might further increase our understanding of the implications of delayed cord clamping.

It is vital that clinicians seek to provide evidence-based care. This ensures better care for the women and babies we serve, and emphasizes a culture of attentiveness to clinical evidence. Based on currently available published studies, we conclude that delayed clamping of the umbilical cord should be routinely considered for all women. Waiting 1 to 3 minutes (or until pulsations stop) to cut the umbilical cord has been shown to have numerous benefits for the newborn without additional risk to either the newborn or mother.

References

1. Weeks A. Umbilical cord clamping after birth. BMJ. 2007;335:312–313.
2. Hutton EK, Hassan ES. Late vs early clamping of the umbilical cord in full-term neonates: Systematic review and meta-analysis of controlled trials. JAMA. 2007;297:1241–1252.
3. McDonald SJ, Middleton P. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes (review). Cochrane Database Syst Rev. 2008;2:CD004074.
4. Wyllie J. The role of resuscitation drugs and placental transfusion in the delivery room management of newborn infants. Semin Fetal Neonatal Med. 2008;13:416–423.
5. Jahazi A, Kordi M, Mirbehbahani NB, Mazloom SR. The effect of early and late umbilical cord clamping on neonatal hematocrit. J Perinatol. 2008;28:523–525.
6. Rabe H, Reynolds G, Diaz-Rossello J. Early versus delayed umbilical cord clamping in preterm infants (review). Cochrane Database Syst Rev. 2004;4:CD003248.
7. Van Rheenen P, de Moor L, Eschbach S, de Grooth H, Brabin B. Delayed cord clamping and hemoglobin levels in infancy: A randomized controlled trial in term babies. Trop Med Int Health. 2007;12:603–616.
8. Van Rheenen P, Brabin B. A practical approach to timing cord clamping in resource poor settings. BMJ. 2006;333:954–958.
9. Cernadas J, Carroli G, Pellegrini L, et al.The effect of timing of cord clamping on neonatal venous hematocrit values and clinical outcome at term: A randomized, controlled trial. Pediatrics. 2006;117:779–786.
10. Levy T, Blickstein I. Timing of cord clamping revisited. J Perinatal Med. 2006;34:293–297.
11. Rosenkrantz TS. Polycythemia and hyperviscosity in the newborn. Semin Thromb Hemost. 2003;29:515–527.
12. Ultee CA, van der Deure J, Swart J, Lasham C, van Baar AL. Delayed cord clamping in preterm infants delivered at 34 36 weeks' gestation: A randomized controlled trial. Arch Dis Child Fetal Neonatal Ed. 2008;93:F20–F23.
13. Strauss RG, Mock DM, Johnson KJ, et al. A randomized clinical trial comparing immediate versus delayed clamping of the umbilical cord in preterm infants: Short-term clinical and laboratory endpoints. Transfusion. 2008;48:658–665.
14. Lim R. Lotus birth: Asking the next question. Midwifery Today Int Midwife. 2001;58:14.

15. Mercer JS, Erickson-Owens DA, Graves B, Haley MM. Evidence-based practices for the fetal to newborn transition. J Midwifery Womens Health. 2007;52:262–272.

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