Leaving well alone in the third stage of labour

Posted on July 7, 2014

In this review of newborn and maternal physiology following birth, **Dr Sarah J Buckley** focuses on the importance of supporting the newborn's transition by delayed, or no, umbilical cord clamping.

The third stage of labour, delayed cord clamping or, simply, non-interventionist birth?

The third stage of labour is a powerful and mysterious time; more important than we acknowledge and more complex than we know. These thirty minutes or so, which begin as the mother births her baby and finish as she births her baby's placenta, are usually uneventful compared to the drama of labour and birth, leading many (including many care providers) to think that the birth is already completed. However, enormous changes are happening in the brain and body of mother and baby, all of which are crucial for their survival in the short, medium and long-term. The substantial contribution of the third stage to species survival predicts that evolutionary investment will be high, with substantial sophistication incorporating multiple systems and adjustments.

For the mother, the major adjustment is the shift from pregnant to non-pregnant and especially the sudden separation of her baby's placenta, which has been intimately associated with her cardiovascular system for the duration of her pregnancy. As the baby's placenta peels off her shrinking uterine wall, rather like a postage stamp peeling off a deflating balloon, she must seal the blood vessels on her side so that her uterine blood supply, flowing at one-half to one litres per minute, will not haemorrhage from the torn vessels.

This physiological miracle is accomplished by the mother’s uterine muscle fibres, which begin to contract and retract immediately after birth forming “living ligatures” that tighten like a purse-string, kinking and sealing off each maternal arteriole. The uterine contractions that provoke this life-saving haemostatis are triggered by surges of oxytocin, released in a crescendo from the new mother’s pituitary as she gives birth. Ongoing maternal pulses of oxytocin are released as she gazes at and touches her baby, and as her newborn massages, licks, and finally suckles her breast Matthiesen et al (2001). Maternal oxytocin levels peak around the time of placental expulsion Nissen et al (1995) and, in all mammals, oxytocin plays a major role in switching on instinctive mothering behaviour at this time Nelson & Panksepp (1998).

Other hormonal systems are also active in the new mother’s brain and body to adapt her to her new maternal role. These include beta-endorphin, the body’s natural opiate and a hormone of attachment, which peaks at birth: adrenaline and noradrenaline, which are elevated in the minutes after birth and ensure that both mother and baby are wide-eyed and alert at first contact (noradrenaline is also a hormone of attachment) Nelson & Panksepp (1998); and prolactin, which reduces stress and augments maternal behaviour Grattan (2001) likely also beginning its role as the major hormone of breastmilk synthesis during and soon after labour and birth.

Postpartum elevations of these hormones, which are even higher and more sustained within the brain than levels measured in the bloodstream Gimpl & Fahrenholz (2001),ensure the devoted maternal care that will optimize offspring survival through to reproductive maturity, and that will be replicated by female offspring with their own young Pedersen & Boccia (2002).Newborn and maternal hormone elevations in the hour following birth also ensure an optimal start to breastfeeding, as initiated by the baby and supported physiologically, hormonally, and behaviourally by the mother Buckley (2009).

For the baby, the major changes during third stage involve the respiratory and cardiovascular systems. These two immediate adjustments, both crucial for survival, are interrelated and both require the extra volume of blood that Mother Nature provides for an optimal newborn transition.

An ongoing supply of oxygen is a physiological necessity, and so, beginning at birth, blood is rerouted away from the placenta (which is reducing its oxygenating capacity) and towards the newly-functioning lungs. Over this time, the pulmonary blood flow increases from 8 percent of foetal cardiac output to 40 percent in the newborn, with this extra blood filling the alveolar capillaries, where oxygenation takes place.

Newborn circulatory rerouting involves the closure of the shunts from umbilical cord to liver and heart, (ductus venosus); from right to left atrium (foramen ovale) and from pulmonary trunk to descending aorta (ductus arteriosus), most of which are aimed at supporting the new pulmonary circuits.

Other major roles of the placenta, chief waiter in the “hotel de womb”, must also be performed by the newborn kidney, liver, gut, and skin. These newly-functioning organs, whose vascular beds were relatively unfilled in-utero, also require extra blood for optimal perfusion and function.

Mother Nature’s superb design for this time involves a gradual redistribution of blood in the minutes after birth, adding up to a substantially-increased blood volume in the newborn, compared to the foetal, body. This haemotological top-up, known as the placental (or placento-foetal) transfusion, comes from blood that is temporarily held in the placenta and is transferred to the newborn in several stages.

According to Dunn (1984), during the baby’s final passage through the mother’s lower vagina, pressure on the cord obstructs the low-pressure umbilical vein, which prevents blood returning from placenta to baby and results in an increased blood volume within the placenta. (The higher-pressure artery is not affected, so that blood can flow from baby to placenta but not back again).
This placental back-log may help to delay placental detachment by making the placenta more rigid. Delayed detachment gives the newborn an ongoing source of oxygenated placental blood that is an important back-up, especially if the baby is slow to breathe. Observations that the first five or so newborn breaths are not effective in gas exchange Ullrich & Ackerman (1972) and that placental respiration continues at normal efficiency for at least 37 seconds after birth Marquis & Ackerman (1973), underline the importance of this back-up system for all newborns.
As the baby emerges, pressure on the umbilical vein is released and the bolus – around 66 mL – of warm, oxygenated, pH-balanced blood that was back-logged in the placenta enters the baby’s circulation Dunn (1984). This occurs within seconds of birth, as evidenced by two studies in which weight gain (reflecting incoming blood) has been continuously recorded from birth Diaz-Rossello (2006).
This placental transfusion, also called the placento-foetal redistribution, is augmented by the new mother’s third stage contractions, which compress the in-utero placenta and so push blood towards the baby. Between contractions, blood can return from baby to placenta through the umbilical vein, which closes later than the artery, and which can transport blood in either direction. This transfusion takes place over several minutes, with the majority of blood transferred within three minutes of birth.

The final amount of blood that is transferred from placenta to newborn can vary from 54 to 160 mL Usher et al (1963), implying that different babies have different circulatory needs and also suggesting that newborns can self- regulate their final blood volume. This may happen through adjustment of umbilical vein flow or other means: Gunther (1957), who continuously recorded newborn weight after birth, showed a reduction in weight (therefore a transfer of blood back to the placenta) during a crying episode, likely due to increased systemic pressure.

The average newborn blood gain following the placental transfusion is around 100ml. Diaz-Rossello (2006), who also recorded newborn weight gain showed a final average weight gain of approximately 100g; equivalent to 100ml of blood. This is around one-third of the total blood volume of an average term newborn (300-350 ml), and so represents a major circulatory contribution.

This blood is also rich in protein and nutrients (containing, for example, the equivalent iron in 100 litres of breastmilk Zlotkin (2002)); in red cells (delayed clamping increases red cell numbers by up to 60% Yao et al (1969)) and in haematopoietic stem cells, which will migrate to the bone marrow and differentiate into various blood and immune cells. The deliberate withholding of newborn blood for so-called “cord blood banking”, which involves taking all or most of this 100ml, has no discernable benefit to the baby Diaz-Rossello (2006) and we have not investigated the harm that may result from deprivation of newborn stem cells Buckley (2009).

The extra blood volume, as well as its components, is also important for an optimal transition. Mercer’s model of neonatal transitional physiology Mercer & Skovgaard (2002) demonstrates the importance of adequately filling the pulmonary capillary networks that surround each alveoli and which, when filled with blood, make the alveoli erect, even before lung inflation. According to studies by Jaykka (1957), the pressure needed to inflate the lungs is substantially lower when the pulmonary vascular beds are pre-filled and the alveoli are erect.

The placental transfusion also aids the clearance of the fluid that fills the foetal lungs, which is optimized by the high levels of plasma proteins associated with a full placental transfusion. Good levels of plasma proteins ensure that the blood colloid osmotic pressure (COP) is high enough to pull the more dilute lung fluid across the alveolar membrane and into the blood stream by osmosis. Both volume and COP effects will optimize newborn lung function, and may be compromised by early clamping.

The baby whose cord is clamped immediately after birth, especially within the first ten to twenty seconds, will lose not only the nutrients, stem cells, and red cells, but also the extra blood volume and will be hypovolemic, to a greater or lesser extent Dunn (1984). Diaz-Rozello (2006) comments, “For the neonate, it is as if 25% of its volemia is bled into the placenta (p. 559).”

Recent randomized controlled trials of early versus delayed cord clamping have highlighted the extra risks of iron deficiency and anaemia in infancy associated with early clamping, compared with a delay of even 30 seconds. A 2007 meta-analysis, published in JAMA, suggests that early cord clamping increases the risk of anaemia by five times at one to two days; and doubles the risk at age two to three months, compared to late-clamped babies. In this analysis, early clamped infants also had lower iron stores at six months Hutton & Hassan (2007).

Concerns about jaundice are often raised in relation to delayed cord clamping. After birth, any red cells that are excess to newborn requirements will be broken down, with red cell haeomoglobin being converted to water-soluable biliverdin and eventually to fat-soluble

bilirubin. Higher numbers of red cells associated with delayed clamping are therefore likely to cause some degree of jaundice, which occurs among all newborn mammals and is probably an important and deliberate postnatal adaptation. Bilirubin is a potent antioxidant that can protect newborns from the sudden “hyperoxia” that occurs with the transition from low oxygen levels in the womb to high levels on exposure to room air Sedlak & Snyder (2004a). This “beneficent” role of bilirubin Sedlak &, Snyder (2004b) was confirmed in a 2008 study Shekeeb Shahab et al (2008), which showed that mild to moderately jaundiced newborns have better antioxidant status than less jaundiced babies, which deteriorates when phototherapy is used to reduce bilirubin levels.

Note that studies do not show an excess of severe jaundice (such as would cause kernicterus, or brain damage) in babies who have had late clamping. Two recent reviews, including more than 1000 late-clamped babies, both concluded that phototherapy or exchange transfusion for jaundice were no more common among late-clamped compared to early-clamped newborns Hutton & Hassan (2007); van Rheenen et al (2006).

Jaundice is also mentioned as an outcome in the recent Cochrane review of the timing of umbilical cord clamping McDonald & Middleton (2008). The reviewers concluded that jaundice requiring phototherapy may be increased with delayed clamping: this conclusion is counter to the two reviews mentioned above, and is critiqued in detail elsewhere Buckley (2009).

Similarly, concerns that “overtransfusion” from delayed clamping will make the blood of healthy newborn babies too thick (polycythemia) and cause “hyperviscosity syndrome”, where extremely viscous blood cannot flow through the small vessels, are not based on good studies Mercer & Skovgaard (2002). As the authors Hutton & Hassan (2007) of the JAMA review conclude:

“Delaying clamping of the umbilical cord in full-term neonates for a minimum of 2 minutes following birth is beneficial to the newborn, extending into infancy. Although there was an increase in polycythemia among infants in whom cord clamping was delayed, this condition appeared to be benign (p. 1241).”

Although the above discussion is generally focused on healthy term newborns, it is important to note that premature babies are at even greater risk from early clamping, because the preterm placenta is relatively larger relative to the body and holds more blood to be transferred to the baby. Cochrane guidelines are unequivocal about the importance of delayed clamping in premature newborns Rabe et al (2004).

Compromised newborns may especially need the blood and oxygen that the placental transfusion provides. Ironically this group is especially likely to have their cord clamped early and be taken away for resuscitation, often because resuscitation facilities are further than a cord-length away. UK obstetrician Andrew Weeks advocates allowing compromised newborns at least one minute for placental transfusion, and comments: “In these days of advanced technology, it is surely not beyond us to find a way of keeping the cord intact during the first minute of neonatal resuscitation Weeks (2007, p. 313).”

Similarly, babies born by Caesarean are very likely to miss their placental transfusion: Weeks recommends that surgical staff "wait a minute" before clamping the Caesarean baby's cord, with the baby kept warm on the mother's legs Weeks (2007).

Thankfully, international studies and guidelines are beginning to acknowledge harms from early clamping and promote a normal neonatal transition. Weeks concludes: "There is now considerable evidence that early cord clamping does not benefit mothers or babies and may even be harmful." and recommends a delay of three minutes, with the baby on the mother's abdomen Weeks (2007). The UK RCOG has also acknowledged possible harms of early clamping on infant iron status Royal College of Obstetricians and Gynaecologists (2008), and comment "It is increasingly difficult to justify routine early cord clamping, especially for preterm births Royal College of Obstetricians and Gynaecologists (2008, p. 3)."

A recent joint statement by the International Confederation of Midwives and the International Federation of Gynaecologists and Obstetricians, as part of the Safe Motherhood project International Confederation of Midwives & International Federation of Gynaecologists and Obstetricians (2004) also advocates that the baby's cord should not be cut until pulsation has ceased. (The role of oxytocics, which are still advocated under this new form of "active management", is discussed elsewhere Buckley (2009)).

A physiological transition for mother and baby would, to my mind, exclude the cord clamp altogether, with the cord cut only after the mother has birthed her baby's placenta, at which time very little blood is spilled with cord cutting. Non-severance of the cord (lotus birth Buckley (2005, pp. 40-43); Rachana (2000)) is another way to ensure a full physiological transition for mother and baby.

In conclusion, we can trust Mother Nature's superb design for mothers and babies in third stage, as well as in birth. For healthy mothers and babies, for Caesarean newborns, for premature babies and for babies who require resuscitation, an optimal transition can be supported by leaving well alone in the third stage of labour.

Drying and shrinking umbilical cord and placenta with Jacob's lotus birth

This post was originally published in Birthspirit Midwifery Journal 2009; 1: 29-34. Sarah J Buckley is a New Zealand-trained General Practitioner, mother of four homeborn children and author of the internationally-acclaimed book *Gentle Birth, Gentle Mothering.* She lives in Brisbane, Australia.

Reposted on this website http://www.birthspirit.co.nz/leaving-well-alone-third-stage-labour/