Effect of Milking Versus Delayed Umbilical Cord Clamping on Physiologic Anemia of the Newborn Infant

Thesis

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List of Abbreviations

Abbr.	Full-term
ACOG	: American College of Obstetricians and Gynecologists
AOP	: Anemia of prematurity
CB	: Cord blood
CCT	: Controlled cord traction
DCC	: Delayed cord clamping
ECDs	: Emergent cesarean deliveries
ELBW	: Extremely low birth weight
EPO	: Erythropoietin
GI	: Gastrointestinal
Hb	: Hemoglobin
HIE	: Hypoxic ischemic encephalopathy
HSCs	: Hemopoietic stem cells
IVH	: Intraventricular hemorrhage
MUC	: Milking the umbilical cord
NEC	: Necrotizing enterocolitis
NICU	: Neonatal intensive-care unit
NRFHR	: Nonreassuring fetal heart rate
P.C.	: Postconception
PFT	: Placento-fetal transfusion
r-Epo	: Recombinant erythropoietin
ROP	: Retinopathy of prematurity
SD	: Standard deviation

SGA : Small-for-gestational-age (SGA

SPSS : Statistical package for social science

UA : Mbilical artery

UC : Umbilical cord

UV : Umbilical vein

VLBW : Very low birth weight

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Introduction

Cord clamping is part of active management of the third stage of labour, a package of care aimed at reducing the risk of postpartum haemorrhage for the women***(Aladangady et al., 2006)***.Before the clamps are applied the infant can either be placed on the mother's abdomen (above the level of the placenta), between the mother's thighs (at the level of the placenta) or held below the level of the placenta***(Jones et al., 2003).***Blood flow from the placenta to the infant will depend on which position is used. Some birth attendants also 'milk' the cord towards the infant before clamping, as it can contain up to 20 mL of fetal blood***(Brune et al., 2002).***

In term infantsincreasing placental transfusion by delaying cord clamping may increase respiratory morbidity after birth***(McDonald, 2008).***Regarding delayed cord clamping (DCC) increased blood volume associated with it also has been shown to significantly increase hematocrit value and blood pressure, while reducing red blood cell transfusion andnecrotizingenterocolitis (NEC) rates in preterm infants***(Rabe et al., 2012).***

Many Canadian and European centers have adopted DCC in this neonatal population, but DCC has not gained wide acceptance in the United States***(Sommers et al., 2012)***. Although DCC frequency and reasons for not implementing

DCC nationally are unknown, in part, it may be due to concern about delaying resuscitation until the cord is clamped and cut, which is 60-120 seconds after delivery***(Niermeyer et al., 2013).***

Recent studies have evaluated the process of milking the umbilical cord (MUC) as an alternative to DCC***(Takami et al., 2013).*** In several small studies, compared with DCC, MUC has been shown to provide a similar increase in hematocrit value and blood volume over a shorter period of time, to reduce red blood cell transfusion requirements, and to improve cardiovascular function and stability and has been associated with similar reduced rates of major neonatal morbidities that includeintraventricular hemorrhage (IVH) and NEC in preterm infants***(March et al., 2013).***

Potential disadvantages include delay in resuscitation, hypothermia, polycythaemia, hyperbilirubinaemia needing treatment and a possible risk of intraventricularhaemorrhage***(Takami et al., 2012).*** If there are benefits for preterm infants in the first few days and weeks of life, it would also be important to assess whether these short-term benefits are reflected in improved long-term outcome***(Hosono et al., 2009).***

Physiologic anemia should be regardedas a developmental response of the infant's erythropoietic system

due to the interaction of several factors: a relative decrease in bone marrow erythropoietic activity, a relative increase in the rate of hemolysis, and hemodilution due to a rapid expansion of the blood volume. These factors tend to be more extreme in low-birth-weight infants and result in a more severe degree of anemia at an earlier age.At the nadir of the physiologic anemia in full-term infants, hemoglobin levels may be as low as 9.5 to 10 Gm. per 100 ml. at 6 to 8 weeks of age, and in premature infants 6 to 7 Gm. per 100 ml. at 3 to 7 weeks of age***(Richard, 1971).***

Patel et al (2014) concluded that Milking Umbilical Cord (MUC) improves early hemodynamic stability and is associated with lower rates of serious morbidity and death among extremely low gestational age neonates.

To our knowledge, milking umbilical cord has not completely evaluated in comparison with early and delayed cord clamping although, it is important maneuver.

Aim of the Work

This study aims to compare the effect of Milking of umbilical cord versus delayed cord clamping on infant Hemoglobin level at months from delivery.

The Placenta

The placenta is the least understood human organ and one of the more important, not only for the health of mother and her fetus during pregnancy but also for the lifelong health of both ***(Guttmacher et al.,2014).***

The health of the mother is affected with Placental structure and function, as seen in the development of insulin resistance ***(Lacroix et al,2013)***and of preeclampsia, gestational hypertension, and eclampsiain pregnancy***(Zhou et al, 2013).***

Placental dysfunction affects the fetus, causing premature labour and fetal growth and neurodevelopmental abnormalities ***(Barker, 2013).***

The concept of "placental origins of adult disease" stem from studies where variations in placental development affect the supply of nutrients to the fetus and the development of systems linked to adult diseases ***(Larsen, 2012)***.In addition, placental size and shape have been linked to maternal nutrition and the lifespan of men**(*** ***Krishnaveni, 2011)***.Pregnancy is a "stress test" for lifelong maternal health; placental function may be both a marker and cause of future cardiovascular disease***(Rich-Edwards,2014).***

Understanding the placenta would lead to both preventive and therapeutic interventions with lifelong impact. New understanding and monitoring of placental function could also help identify pregnancies at increased risk for preterm labour and even lead to decreased rates of prematurity, an important mother health needs ***(Roseboom, 2012).***

Placenta-based approaches to prevention of low birthweight could reduce rates of stroke, hypertension, and myocardial infarction when the fetus become adults ***(Padmanabhan et al.,2013).***

Structure of the Placenta

The placenta contain Villous "trees",there are the main structure. Based on the developmental stage, villous structure, vessel branches, histologic features, and vessel-cell type components, at least five types of villi have been described ***(Castellucci, 2006)***

(1) Stem villi.: Stem villi connect to the chorionic plate and are characterized by fibrous stroma containing large vessels and microvessels ***(Kaufmann,2006).***

(2) Immature intermediate villi: Immature intermediate villi are bulbous, peripheral, and immature continuations of stem villi.

(3) Mature intermediate villi:Mature intermediate villi are long, slender, peripheral ramifications that lack fetal vessels in the stroma. Mature intermediate villi produce the terminal villi ***(Baergen,2006).***

(4) Terminal villi: Terminal villi are linked to stem villi by intermediate structures. These villi are grape-like structures characterized by a high degree of capillarization and highly dilated sinusoids ***(Kaufmann,2006).***

(5) Mesenchymal villi: Mesenchymal villi are the most primitive type of villi during early stages of pregnancy. Mesenchymal villi have loose stroma, inconspicuous capillaries, and two complete surrounding trophoblast layers, a cytotrophoblast layer surrounding the villous core, and an outer syncytiotrophoblast on the villous surface ***(Burton,2009).***

Placenta villous development starts with mesenchymal villi. Up to 5 weeks postconception (p.c.), all placental villi are of the 'mesenchymal' type (containing trophoblast and villous sprouts) ***(Morgan,2010)***.

Mesenchymal cells later invade these villi forming secondary villi (immature/intermediate villi) and also giving rise to placental blood vessels.