

## Strictly Physiological Neonatal Transition at Birth

David JR Hutchon FRCOG

Consultant Obstetrician, Memorial Hospital, Darlington, England, United Kingdom

### Abstract

For over 100 years, according to some experts, the umbilical cord has been clamped and cut much too quickly after birth. The rationale for this intervention was never established but impatience to separate the neonate and mother was probably the main reason. It was certainly not started with any intended health benefit for the neonate. With the formal recommendation of active management of the third stage of labour [AMTSL] in the 1980's, early cord clamping was included as one of the required elements for successful reduction in post-partum haemorrhage [PPH] probably to facilitate controlled cord traction, one of the other elements of AMTSL. Since the 1980's it has been recognised that early cord clamping plays no place in reducing PPH. Early cord clamping has been shown to have harmful effects on the immediate health of the neonate. The intervention has been withdrawn as part of AMTSL by most authorities and by ILCOR in its advice for the care of the neonate. Early cord clamping was introduced by accident and has well documented short term harms. More research has been called for but is it possible that there are long term benefits of early cord clamping which defy rational explanation?

**Keywords:** Neonatal; Physiology; Cord clamping

### Corresponding author:

Dr. David J R Hutchon FRCOG

✉ djrhutchon@hotmail.co.uk

Consultant Obstetrician, Memorial Hospital, Darlington, England, United Kingdom.

Tel: 00441325253278

**Received:** December 10, 2015; **Accepted:** January 13, 2016; **Published:** January 23, 2016

### Introduction

For over 100 years, according to some experts, the umbilical cord has been clamped and cut much too quickly after birth [1]. The rationale for this intervention was never established but impatience to separate the neonate and mother was probably the main reason. It was certainly not started with any intended health benefit for the neonate [2]. With the formal recommendation of active management of the third stage of labour [AMTSL] in the 1980's, early cord clamping was included as one of the three required elements for successful reduction in post-partum haemorrhage [PPH]. It was probably thought to be needed to facilitate controlled cord traction, one of the other elements of AMTSL. Since the 1980's it has been recognized that early cord clamping has no place in reducing PPH. Early cord clamping has been shown to have harmful effects on the immediate health of the neonates [1]. These harmful effects are greater and more easily shown in the vulnerable preterm baby [3]. The intervention has been withdrawn as part of AMTSL by most authorities [4,5] and by ILCOR [6] in its advice for the care of the neonate. Early cord clamping was introduced by accident and short term harms have been shown in sound scientific studies.

More research has been called for but is it possible that there are long term benefits of early cord clamping which defy rational explanation? Is it necessary to confirm through research that there are long-term harms!

### Evidence of short term effects

The precise details of the circulatory changes and the underlying mechanisms of a physiological transition at birth are not completely understood. During transition the neonate must change from placental to pulmonary respiration and this requires a radical change the circulation of the heart and lungs [7]. These changes have been well investigated in the lamb model and this understanding has led to many questions about the safety of early cord clamping in clinical practice [8]. The procedure clearly interferes with physiological transition and it has been realised that the stage of transition when cord clamping is carried out is more critical than the actual time interval since birth [9]. There are numerous effects of early cord clamping. The most easily measured is the loss of the

placental transfusion, which is essentially the redistribution of a volume of blood which occurs over several minutes after birth.

The volume of the redistribution is variable but early clamping always results in some degree of neonatal hypovolaemia. This is easily demonstrated by weighing the baby continuously over the few minutes after birth [10]. Hypovolaemic blood loss leads to a reduced preload of the heart and to anaemia and iron deficiency over the following six weeks [11]. Severe hypovolaemia may result in a seriously ill neonate [12]. Sudden clamping of functioning umbilical arteries (carrying up to 40 % of the combined output of the heart just before birth) causes a sudden increase in afterload of the heart [13]. Stem cells are proving to be of increasing value and there are large numbers in the residual placental blood after early cord clamping. Thus loss of the placental transfusion denies this first natural stem cell transplant [14]. The blood returning from the placenta to the neonate during transition is oxygenated [15] and loss of this source of oxygen results in lower neonatal oxygen saturation [16]. Early cord clamping leads to a neonatal bradycardia which is not seen if the neonate is allowed a complete transition with the cord intact [17,18]. The only reported benefit of early cord clamping is a slight reduction in the need for phototherapy for jaundice. This finding has been challenged and evidence provided that the reverse is more likely. Early cord clamping may be icterogenic [19].

### Neonatal resuscitation

ILCOR have stated that for the healthy term neonate early cord clamping before one minute after birth should not be carried out. They provide no specific advice about the timing of cord clamping for neonates that do not breathe quickly after birth and who are thought to require positive pressure ventilation [PPV] [20]. The WHO advise that if there is the skill and experience to provide effective ventilation without clamping the cord, this should be the carried out [4]. Accurate and consistent assessment of the condition of the neonate at birth is essential to provide

an effective strategy for neonatal resuscitation at birth [21]. These strategies have been investigated and modified over the past 40 years, [20] but these views were reached in babies that had already failed to transition successfully after early cord clamping. Now that the harm of early cord clamping has been recognized, some of these strategies will need to be reviewed. There is no sense in knowingly affecting the neonatal circulation adversely simply in order to maintain a traditional approach. A consistent and safe approach requires that all neonates requiring ventilator assistance have the same cord management as those babies that do not require any assistance. Some babies may actually require resuscitation as a result of early cord clamping and this must be considered unacceptable [22].

### Resuscitation with the cord intact in practice

Ventilation, together with thermal support, is usually the main and only requirement for successful neonatal resuscitation of the term neonate [22]. Positive pressure ventilation [PPV] can be provided with simple equipment on the delivery bed between the legs of the mother [23]. Positive end expiratory pressure [PEEP] is considered to provide the optimal and safest PPV and is available on most UK maternity units for neonatal resuscitation. The use of air is usually sufficient especially in term neonates although for preterm and sick term neonates supplemental

oxygen, controlled though an oxygen blender, may be required. Providing resuscitation without clamping the cord

using standard equipment is possible [24,25]. These facilities are available on a customized mobile resuscitation trolley now commercially available [26].

### Research

Continued research into an intervention, for which there is no rationale and has already been proven harmful, is unprecedented. The intervention of early cord clamping has remained common practice over the last 40 years. In the majority of neonates the intervention is tolerated and the harmful effects remained unnoticed until uncovered by recent studies. It is inevitable therefore that to provide indisputable evidence of harm from a randomized controlled trial very large numbers are required. If documentation of the intervention is absent then the evidence can only come from formal and expensive prospective research. During these 40 years, with the introduction of evidence based medicine, many traditional interventions, with unproven benefits, have been removed from clinical practice. For example when the toxicity of oxygen was recognized, the use of 100 % oxygen to initiate ventilation in neonatal resuscitation was abandoned. Through convenience, lack of understanding and tradition, the clinical practice of routine early cord clamping remains common throughout the world despite the lack of evidence of benefit. One justification for more research is to change clinical opinion and practice with the results of a trial which are indisputable. However increasingly more researchers and ethical committees are finding it hard to consider that randomly allocating a group of babies to early cord clamping is ethical. This applies equally to babies needing resuscitation. If there is any effect of early cord clamping resulting in the need for resuscitation, [22,27] not only would a randomized control trial be unethical, it would also invalidate the results of the trial. When there is careful adherence to a policy of delayed cord clamping, the number of babies requiring resuscitation is reduced [28]. Term babies requiring resuscitation are relatively rare and usually only anticipated a short time before birth or often at birth. A randomized controlled trial would therefore need to recruit large numbers of subjects, with all the expense involved. Most of the mothers and babies recruited would not be eligible. The only practical way of establishing how much early cord clamping may have affected the health of neonates requiring resuscitation is by cohort studies made possible by universal documentation of the timing of cord clamping together with a policy of avoiding early cord clamping cord clamping. The policy would need to be to try to achieve a physiological transition for all births, with cord clamping only after the neonate has established respiration, usually around five minutes after birth. As this requires the resuscitation to be carried out at the side of the mother with the cord intact, modified equipment, professional co-operation and procedures must be in place [29]. A register of all neonates requiring resuscitation at birth could be set up, similar to or ideally part of the "Each Baby Counts" initiative launched by the RCOG [30]. Within several years it should be possible to determine what effect early cord clamping has had on the success of resuscitation at birth.

## References

- 1 Raju TN (2013) Timing of umbilical cord clamping after birth for optimizing placental transfusion. *Curr Opin Pediatr* 25: 180-187.
- 2 RCOG (2015) Clamping of the Umbilical Cord and Placental Transfusion Scientific Impact Paper No. 14 Scientific Impact Paper No. 14
- 3 Rabe H, Diaz-Rossello JL, Duley L, Dowswell T (2012) Effect of timing of umbilical cord clamping and other strategies to influence placental transfusion at preterm birth on maternal and infant outcomes. *Cochrane Database Syst Rev* 15:8.
- 4 World Health Organization, USAID, MCHIP (2013) Delayed clamping of the umbilical cord to reduce infant anaemia.
- 5 NICE guidelines [CG190] (2014) Intrapartum care for healthy women and babies.
- 6 Perlman JM, Wyllie J, Kattwinkel J, Atkins DL, Chameides L, et al. (2010) Part 11: Neonatal resuscitation: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Circulation* 122: S516-538.
- 7 Yigit MB, Kowalski WJ, Hutchon DJ, Pekkan K (2015) Transition from fetal to neonatal circulation: Modeling the effect of umbilical cord clamping. *J Biomech* 48: 1662-1670.
- 8 Bhatt S, Alison BJ, Wallace EM, Crossley KJ, Gill AW, et al. (2013) Delaying cord clamping until ventilation onset improves cardiovascular function at birth in preterm lambs. *J Physiol* 591: 2113-2126.
- 9 Hutchon DJ (2015) Ventilation before Umbilical Cord Clamping Improves Physiological Transition at Birth or "Umbilical Cord Clamping before Ventilation is Established Destabilizes Physiological Transition at Birth". *Front Pediatr* 3: 29.
- 10 Farrar D, Airey R, Law GR, Tuffnell D, Cattle B, et al. (2011) Measuring placental transfusion for term births: weighing babies with cord intact. *BJOG* 118: 70-75.
- 11 Andersson O, Hellström-Westas L, Andersson D, Domellöf M (2011) Effect of delayed versus early umbilical cord clamping on neonatal outcomes and iron status at 4 months: a randomised controlled trial. *BMJ* 343: d7157.
- 12 Vanhaesebrouck P, Vanneste K, de Praeter C, Van Trappen Y, Thiery M (1987) Tight nuchal cord and neonatal hypovolaemic shock. *Arch Dis Child* 62: 1276-1277.
- 13 Gardiner HM (2005) Response of the fetal heart to changes in load: from hyperplasia to heart failure. *Heart* 91: 871-873.
- 14 Tolosa JN, Park DH, Eve DJ, Klasko SK, Borlongan CV, et al. (2010) Mankind's first natural stem cell transplant. *J Cell Mol Med* 14: 488-495.
- 15 Wiberg N, Källén K, Olofsson P (2008) Delayed umbilical cord clamping at birth has effects on arterial and venous blood gases and lactate concentrations. *BJOG* 115: 697-703.
- 16 Smit M, Dawson JA, Ganzeboom A, Hooper SB, van Roosmalen J, et al. (2014) Pulse oximetry in newborns with delayed cord clamping and immediate skin-to-skin contact. *Arch Dis Child Fetal Neonatal Ed* 99: F309-314.
- 17 Brady JP, James LS (1962) Heart rate changes in the fetus and newborn infant during labor, delivery, and the immediate neonatal period. *Am J Obstet Gynecol* 84: 1-12.
- 18 Katheria AC, Wozniak M, Harari D, Arnell K, Petruzzelli D, et al. (2015) Measuring cardiac changes using electrical impedance during delayed cord clamping: a feasibility trial. *Matern Health Neonatol Perinatol* 1: 15.
- 19 Hutchon DJR, Simon EN (2015) Low Apgar, Need for Resuscitation and Neonatal Jaundice. *J Nurs Care* 4: 277.
- 20 Wyllie J, Perlman JM, Kattwinkel J, Wyckoff MH, Aziz K, et al; (2015) on behalf of the Neonatal Resuscitation Chapter Collaborators. Part 7: neonatal resuscitation: International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Resuscitation*. 136: 120-165.
- 21 Hutchon DJR (2014) Technological Developments in Neonatal Care at Birth. *J Nurs Care* 3: 218.
- 22 Niermeyer S, Velaphi S (2013) Promoting physiologic transition at birth: re-examining resuscitation and the timing of cord clamping. *Semin Fetal Neonatal Med* 18: 385-392.
- 23 Van Rhee P (2011) Delayed cord clamping and improved infant outcomes: enough evidence exists to encourage a routine change in practice. *BMJ* 343: 7127.
- 24 Hutchon DJR, Thakur I (2007) How to resuscitate the neonate with the cord intact at caesarean section. *British International Congress of Obstetrics and Gynaecology, London, United Kingdom.*
- 25 Hutchon DJ, Thakur I (2008) Resuscitate with the placental circulation intact. *Arch Dis Child* 93: 451.
- 26 Hutchon D (2014) Evolution of neonatal resuscitation with intact placental circulation. *Infant* 10: 58-61
- 27 Mercer J, Bewley S (2009) Could early cord clamping harm neonatal stabilisation? *Lancet* 374: 377-378.
- 28 Brooks G, MacKenzie S, Salem M (2013) Delayed Cord Clamping: A review of its introduction within a medium-sized UK consultant-led maternity unit. Wansbeck General Hospital, Northumberland. Cutting the cord; an International Conference. University of Birmingham, Birmingham, United Kingdom.
- 29 McAdams RM, Backes CH, Hutchon DJR. (2015) Steps for implementing delayed cord clamping in a hospital setting. *Matern Health Neonatol Perinatol* 1: 10.
- 30 RCOG Each Baby Counts.