



Registered Charity No 1003392

Published in the **HealthWatch Newsletter**

for Science and Integrity in Healthcare

Electronic fetal monitoring in labour and cord clamping at birth: *A comparison of physiology, medical logic and evidence based medicine to reduce prenatal mortality and morbidity*



At first sight there is no obvious relationship between continuous electronic fetal monitoring (EFM) in labour and delayed cord clamping at birth. However both, based on physiological logic, could affect risk of death and morbidity in newborns. The whole purpose of EFM in labour is to identify intrapartum hypoxia (dangerously low oxygen levels) and then to deliver the baby to the care of the neonatal team before any significant brain injury has occurred. Early cord clamping (ECC), originally part of routine third stage management of labour (1), has permitted the rapid transfer of the infant away from the mother for resuscitation when required. In an ideal world recognition of early fetal distress by EFM would result in delivery *before* the onset of asphyxia with little or no neonatal resuscitation being necessary.

However, there is very limited evidence for any benefit of EFM in labour, and the research continues (2,3). A reduction in neonatal seizures is the only benefit shown so far. Early cord clamping was introduced without any evidence and now there is evidence *that it is harmful* (4). The long-standing practice of ECC and the continued practice of resuscitation away from the mother is slowing its removal from practice (5,6). To simplify this discussion we will only include babies born full-term.

EFM

Labour is known to be one of the commonest times when a fetus risks hypoxia (7). The fetal heart rate is well recognised to be affected by hypoxia (8). The modern cardiotocograph, or CTG, can measure and document the foetal heart rate during labour. Although non-invasive, this monitoring cannot be considered completely benign and may be one of the underlying causes of the dramatic rise in the caesarean section rate over the last 30 years (3,9). Interpretations of CTG data made during the birth process, when considered in retrospect, are often considered substandard (10).

Early cord clamping

While the monitoring may be only minimally invasive, the fully invasive nature of early cord clamping has only recently been fully recognised. It has been shown to have no role in reducing the risk of post partum hemorrhage and there is theoretical and randomized controlled trial evidence of considerable harm caused by early clamping (11).

Transition of fetal to neonatal circulation

The patterns of fetal blood circulation and the circulatory system in the neonate are well understood. The process of transition between the two is less well understood but recent computer simulation and lamb studies confirm that there are dramatic changes in the baby's circulation when the cord is clamped early before

the pulmonary circulation is established (12). Early clamping results in a marked increase in afterload of the heart followed by a marked fall in the heart's preload. In some situations it has been proposed that early cord clamping could result in a marked fall in circulation of blood to the brain and hypoxia resulting in an acute neurologic emergency. As a result a few babies will develop permanent brain damage (13). Many of these babies go on to develop cerebral palsy or die. Randomised controlled trials show early cord clamping leads to neonatal anaemia and iron deficiency (3). Other harms are emerging if there is intrapartum cord compression and early cord clamping results in hypovolaemia – severely reduced blood volume (14).

In birth asphyxia, ventilation is a priority (5). Current practice is for the newborn baby to be moved to a resuscitation machine remote from the mother. However it is possible for the cord to remain intact with motherside neonatal resuscitation (15).

The admirable initiative by the RCOG of the Each Baby Counts study has concentrated on term intrapartum care (16). It concluded that staff failed to interpret the cardiotocograph data accurately enough to prevent death and severe morbidity in the neonate. To correct this, the study authors recommended that all staff tasked with CTG interpretation must have documented evidence of annual training. CTG interpretation was *the only specific factor* identified which may have prevented their death or brain injury.

Of course, those assessing CTG monitoring data do so in the comfort of an armchair and with the knowledge of the poor outcome. This finding is not new and it has been thought that an expert computer analysis of the CTG would result in improved interpretation and outcomes. This approach has not, however, shown an improved outcome (17). The intervention of early cord clamping was never considered in the Each Baby Counts study and, in fact, ECC would have been the norm.

There is indisputable evidence that early cord clamping results in a variable degree of hypovolaemia in the newborn baby (18). As with any blood loss, the lower end of the spectrum is tolerated. It is only at the upper extreme that severe problems will occur. This can be volume reductions of as much as 214ml (18).

No matter how good the cardiocotocograph interpretation and no matter how appropriate and timely the delivery of the baby, any subsequent maltreatment of the baby may drown out any benefits of the CTG. If the maltreatment inflicts a very different form of injury it may be obvious. However if the maltreatment results in a similar insult of hypoxia and ischaemia it will be impossible to identify which of the procedures was the cause of the harm.

Cord compression leads to compression of the cord vein greater than in the cord arteries, and a transfer of blood volume from the baby into the placental compartment. The reduced flow of oxygenated blood in the cord vein leads to typical changes in the pattern of the fetal heart. Some cord compression in labour is common. When these babies are delivered there is already a concern, from the CTG, that there may have been some intrapartum hypoxia, and also a concern that there may be a need for neonatal resuscitation. Thus early cord clamping is likely to be common. Early cord clamping in these babies permanently traps the blood in the placenta. But if the cord is left intact after the baby is born and the cord compression has been relieved, there is an opportunity for a rapid return of the blood in the placenta into the neonate. This oxygenated blood may be all that is required to allow the baby to recover on its own. If this recovery is not apparent, resuscitation with ventilation can then be carried out at the side of the mother with an intact cord.

The value of electronic fetal monitoring in labour remains unproven but there is good evidence for the harmful intervention of early cord clamping. Until this is stopped we will never know how many of these baby deaths are truly preventable. The timing of cord clamping must be documented in every birth and the NICE guideline followed for timing.

D J R Hutchon FRCOG

References

1. Downey CL, Bewley S. Third stage practices and the neonate. *Fetal Matern Med Rev* 2009;20:229–46.
2. Williams C. Stillbirth: what politicians and the media fail to understand. *HealthWatch Newsletter* 101, Spring 2016.
3. Alfirevic Z, Devane D, Gyte GML, Cuthbert A. Continuous cardiocotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. *Cochrane Database of Systematic Reviews* 2017, Issue 2. Art. No.: CD006066. DOI: 10.1002/14651858.CD006066.pub3.
4. Andersson O, Lindquist B, Lindgren M, et al. Effect of Delayed Cord Clamping on Neurodevelopment at 4 Years of Age. A Randomized Clinical Trial. *JAMA Pediatr.* 2015;169(7):631-638.
5. Wyllie J, Perlman JM, Kattwinkel J, et al. 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.* 2015;95:e169–e201.
6. McAdams RM, Backes CH, Hutchon DJR. Steps for implementing delayed cord clamping in a hospital setting. *Matern Health NeonatolPerinatol* 2015;1:10.
7. Costa A, Costa F, Ayres-de-Campos D et al. Prediction of fetal acidemia by computer analysis of fetal heart rate and ST event signals. *Am J Obstet Gynecol.* 2009;201(5):464.e1-6.
8. Westerhuis M, Kwee A, van Ginkel A et al: Limitations of ST analysis in clinical practice: three cases of intrapartum metabolic acidosis. *BJOG* 2007;114:1194-1201.
9. Devane D, Lalor JG, Daly S et al. Cardiocotocography versus intermittent auscultation of fetal heart on admission to labour ward for assessment of fetal wellbeing. *Cochrane Database of Systematic Reviews* 2017, Issue 1. Art. No.: CD005122. DOI: 10.1002/14651858.CD005122.pub5.
10. Palomäki O, Luukkaala T, Luoto R, Tuimala R: Intrapartum cardiocotocography: the dilemma of interpretational variation. *J Perinat Med* 2006;34:298-302. DOI:10.1515/JPM.2006.057.
11. NICE (2014) Intrapartum care for healthy women and babies Clinical guideline [CG190]
12. Yigit MB, Kowalski WJ, Hutchon DJ, Pekkan K. Transition from fetal to neonatal circulation: Modeling the effect of umbilical cord clamping. *J Biomech* 2015;48:1662-1670.
13. Hutchon DJ. 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* 2015;3:29.
14. Mercer J, Bewley S. Could early cord clamping harm neonatal stabilisation? *Lancet* 2009;374:377-378.
15. Hutchon DJR, Thakur I. How to resuscitate the neonate with the cord intact at caesarean section. *British International Congress of Obstetrics and Gynaecology, London, United Kingdom, 2007.*
16. Royal Colleges of Obstetricians and Gynaecologists. Each Baby Counts <https://www.rcog.org.uk/eachbabycounts>
17. Brocklehurst P et al. Computerised interpretation of fetal heart rate during labour (INFANT): a randomised controlled trial. *Lancet* 2017;389(10080):1719-29.
18. Farrar D, Airey R, Law GR et al. Measuring placental transfusion for term births: weighing babies with cord intact. *BJOG* 2011;118(1):70-7.