

# Umbilical cord management: Where are we in 2024?

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‘The common method of tying and cutting the navel string in the instant the child is born, is likewise one of those errors in practice that has nothing to plead in its favour but custom’

Charles White, 1773

“The blood is pressed into the child by the uterine contractions, and is part aspirated by the expanding lungs...such children lose less weight and are less subject to disease...”

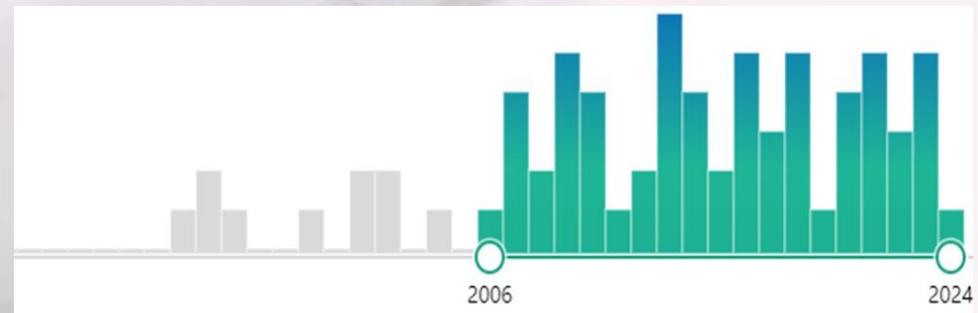
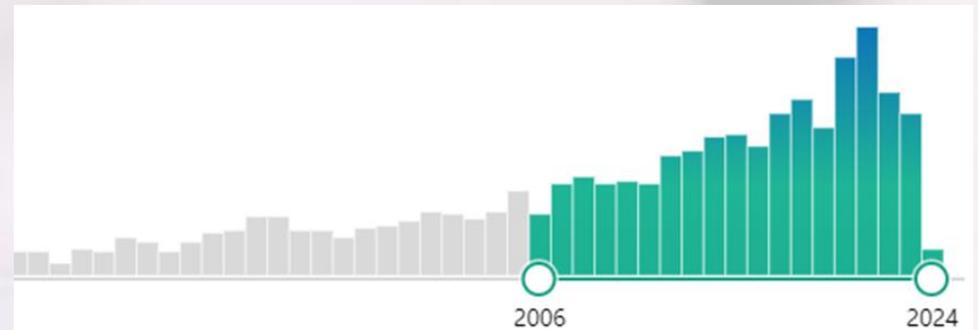
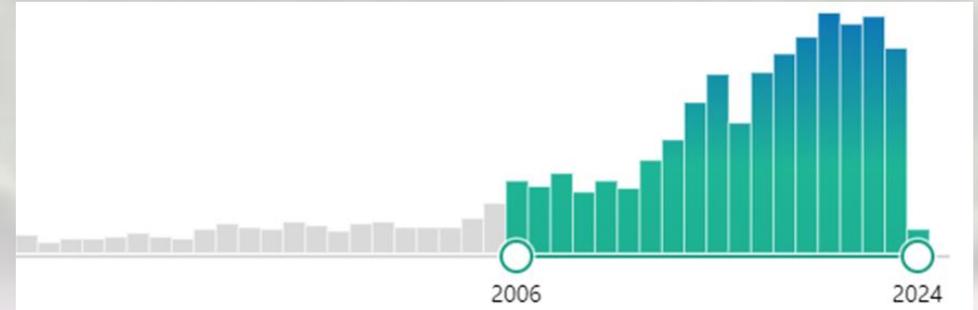
“It is an error, on the other hand, to force the blood of the placenta into the child by stripping the cord toward the child. This overloads its blood vessels, causes icterus, even apoplexy...”



1930 DeLee JB (1930)  
American physician  
Father of modern obstetrics

# Publications since 2006 – Pub Med

- Placental transfusion newborn ~ 800
- Umbilical cord management ~ 800
- Resuscitation on placental circulation 56



# Definitions

- ECC/ICC (early/Immediate cord clamping) – <30 seconds of age
- DCC (delayed cord clamping) – 30-60 seconds of intact cord
- PBCC (physiological-based cord clamping) – waiting until after onset of respiration 3-5mins (ABC-Aeration, Breathing, Clamping trial)
- Cord Milking – ~ 20 cm of cord stripped towards baby 3 to 4 times in <20 sec

# Physiologic Effects

- In the second trimester of pregnancy the circulating feto/placental blood volume is ~100–120 ml/kg
- Up to 50% of this amount can remain in the placenta at the time of delivery of a preterm infant
- Placental transfusion is 'actively pulled' into the pulmonary bed by spontaneous breathing

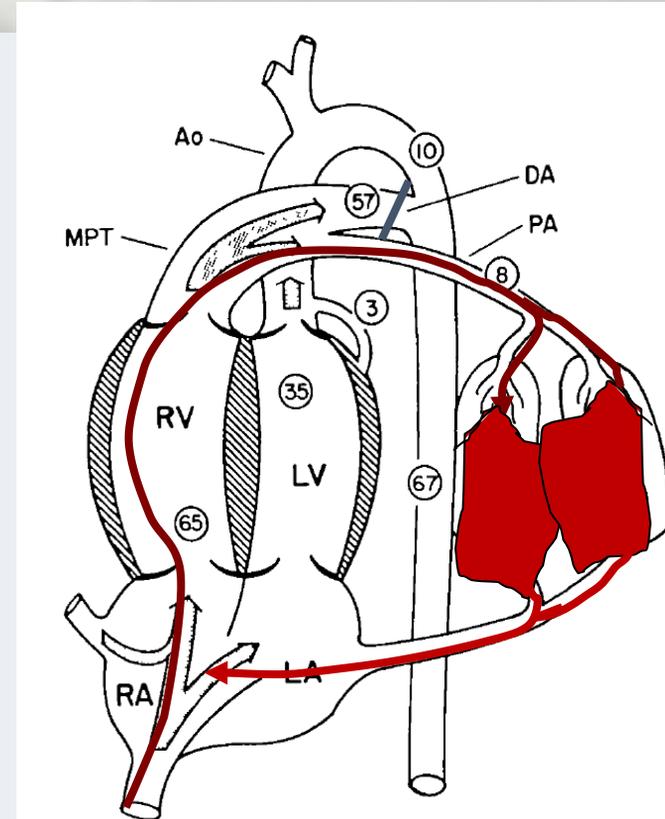
# Physiological changes...in nature

- **Infant cries**

- **↑** Functional Residual Capacity
- **↓** Pulmonary Vascular Resistance
- **↑** RV Output, PVD & Lung perfusion
- **↑** Blood return to LA
- **↑** LV filling & output
- **↓** PDA flow

- **Cord is severed**

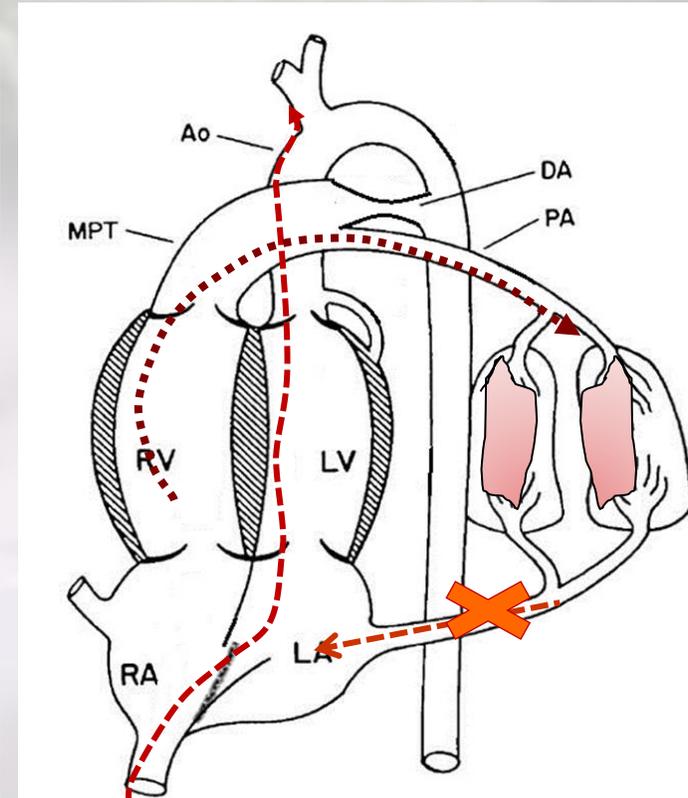
**Net effect ↑ systemic perfusion**



Drawings by A.M. Rudolph  
*Circ Res*, 57:811, 1985

# Immediate cord clamping

- **UV clamped**
    - ↓ Right ventricle (RV) preload
  - **UA clamped**
    - ↑ Increase in LV after-load
  - **No lung expansion**
    - ↓ Pulmonary perfusion and pulmonary venous return to LA
    - ↓ RV output to LA
- Net Effect** ↓ systemic perfusion



Drawings by A.M. Rudolph  
*Circ Res*, 57:811, 1985

# Benefits to the preterm

- Reduction in mortality of up to 32%
  - $\leq 32$  weeks one additional survivor for every 33 babies receiving at least 60 seconds of DCC
  - $\leq 28$  weeks the NNB reduces to 20
- Reduction in IVH
- Reduction in late onset sepsis
- Reduction in NEC
- Improved hemodynamic stability less need for inotropes
- Reduction of blood transfusions 10%
- Lower risk of death or severe neurodevelopmental impairment at 22-26 months

# Benefits of DCC for term and Preterm Babies – WHO 2023

- Improved postpartum adaptation
- Higher hemoglobin and ferritin
- Improved neurodevelopment @ 4yrs
- Decreased mortality in NICU and up to 2yrs by 30%

SJ McDonald, P Middleton, T Dowswell, PS. Morris, Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. *Cochrane Database Syst Rev* (7) (2013), Article CD004074

B Jasani et al. Association of umbilical cord management strategies with outcomes of preterm infants: a systematic review and network meta-analysis. *JAMA Pediatr*, 175 (4) (2021), Article e210102,

KP Robledo, et al. Effects of delayed versus immediate umbilical cord clamping in reducing death or major disability at 2 years corrected age among very preterm infants (APTS): a multicentre, randomised clinical trial *Lancet Child Adolesc Health* (2021), Article S2352464221003734,

# USA

## ACOG (2023) American College of Obstetricians and Gynecologists

- Delay cord clamping in vigorous term/preterm infants for at least 30–60sec
  - Prevent iron deficiency in the first year of life
    - Iron deficiency in infancy/childhood linked to potentially irreversible impaired cognitive, motor, and behavioral development
    - Transfer of immunoglobulins and stem cells beneficial after cellular injury/inflammation/organ dysfunction especially after preterm birth
- Cord milking not to be used for preterm infants <28 weeks of gestation
  - Insufficient evidence to either support or refute benefits of UCM in infants >32 weeks of gestation
- Transfusion of additional blood volume at birth exceeds benefits of banking for possible future use

# Canada

## SOGC/CPS (2022)

- <37 wks. and <28 wks. singletons DCC recommended for 60 -120 sec
- >37wks. DCC 60 sec. Comment about jaundice needing Photo Tx with >60 sec
- Twins – DCC for 30 to 60 seconds can be considered
- UCM not recommended <32 wks.
- Uterotonic – after delivery of preterm / delivery of shoulder in term
- **Absolute contraindications**
  - Maternal resuscitation
  - Fetal hydrops
  - Cord bleeding/bleeding vasa previa
  - Twin-Twin transfusion/Twin anemia polycythemia sequence

# UK

## RCOG (2015)

- 'The cord should not be clamped earlier than is necessary, based on clinical assessment of the situation.
- 1-3 mins DCC recommended, unless the neonate is asphyxiated/needs immediate resuscitation

## NICE (2017)

- Cord not to be clamped in the first 60 seconds, except where there are concerns about the cord's integrity or the baby's heart rate

# UK

## BAPM (2020)

- Waiting for a minimum of 60 seconds before cord clamping
- Almost no indications for early cord clamping
- Absolute contraindication to DCC
  - Massive maternal hemorrhage needing acute resuscitation
  - Cord issues – bleeding vasa previa/snapped cord which could lead to significant bleeding from the baby
- Complete placental abruption
  - If placenta is delivered with baby - can be held above the baby and clamped at 60 seconds
  - Umbilical cord milking could also be considered in this situation.

# Australia/New Zealand

## ANZCOR (2024)

- < 34 wks. vigorous after birth defer cord clamping for at least 30 seconds
- $\geq 34$  weeks' vigorous cord clamping  $\geq 60$  seconds
- No UCM <28+0 wk.
- Insufficient evidence to recommend UCM  $\geq 34$  wks

# International

## International Federation of Gynecology and Obstetrics (2021)

- Avoid cord clamping <30 seconds for preterm births
- 30 sec to 3 minutes until the cord is collapsed and white can be considered in term babies
- Attempt to support spontaneous breathing

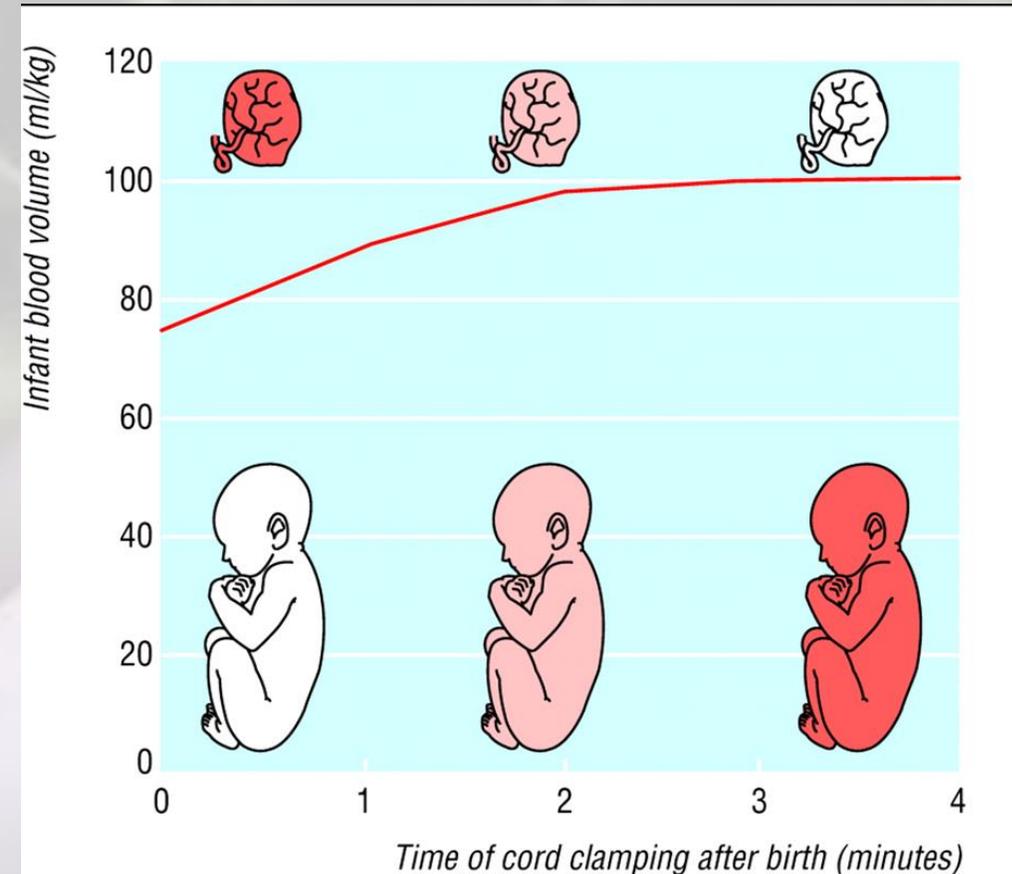
## WHO (2023)

- DCC not earlier than 1 min after birth for improved infant health and nutrition outcomes

# Generational change in newborn care

## DCC endorsed by

- WHO
- RCOG
- SOGC
- ILCOR
- NICE
- RANZCOG
- IAP
- AAP
- ACOG
- ERC



van Rheenen P F, Brabin B J. A practical approach to timing cord clamping in resource poor settings BMJ 2006; 333 :954

**There are almost no absolute indications for ECC / contraindications to DCC**

# Summary of all recommendations

## Placental Transfusion

- Recommended for babies of all gestation, with immediate and long-term benefits
- DCC for 30-60 seconds in all babies
- Breathing while on placental circulation is beneficial
- UCM not recommended < 28 wks.\*
- DCC more beneficial than cord blood banking

## Absolute contraindications are few

- Risk of fetal/newborn blood loss (ruptured vasa previa, snapped cord)
- Maternal resuscitation
- TTTS/TAPS
- Fetal hydrops\*
- Complete placental abruption\*

# DCC - Measures to adopt

## **Discuss/plan for DCC prior to delivery**

- Position – Ensure airway patency by optimizing head position
- Stimulation - Gentle stimulation to encourage breathing
- Measures to optimize thermal stability
- Encourage breathing before cord clamping



# Limit cord palpation



Thick-walled artery partially compressed by palpation

Thin wall umbilical vein easily compressed and occluded



- Cord palpation during DCC is inaccurate for determination of newborn heart rate 55%
- Compressing the cord by palpation potentially decreases umbilical vein patency and placental transfusion.

# Where are the gaps

- UCM – Changing evidence
- Optimal duration of DCC undefined – time / position
- Management of non-vigorous babies
- Recommendations for high risk newborns

# UCM 35–42 wks. (2023)

- Cluster-randomized crossover trial USA/Canada/Poland 2019 – 2021
- 16,234 screened - 1780 eligible (905 UCM/875 ECC)
- 1730 primary outcome data analysis
- No reduction in NICU admission.
- UCM - higher hemoglobin/received less CPR
- Lower incidence of moderate to severe HIE less need for TH
- First RCT with evidence that UCM in non-vigorous infants is feasible safe and superior to ECC

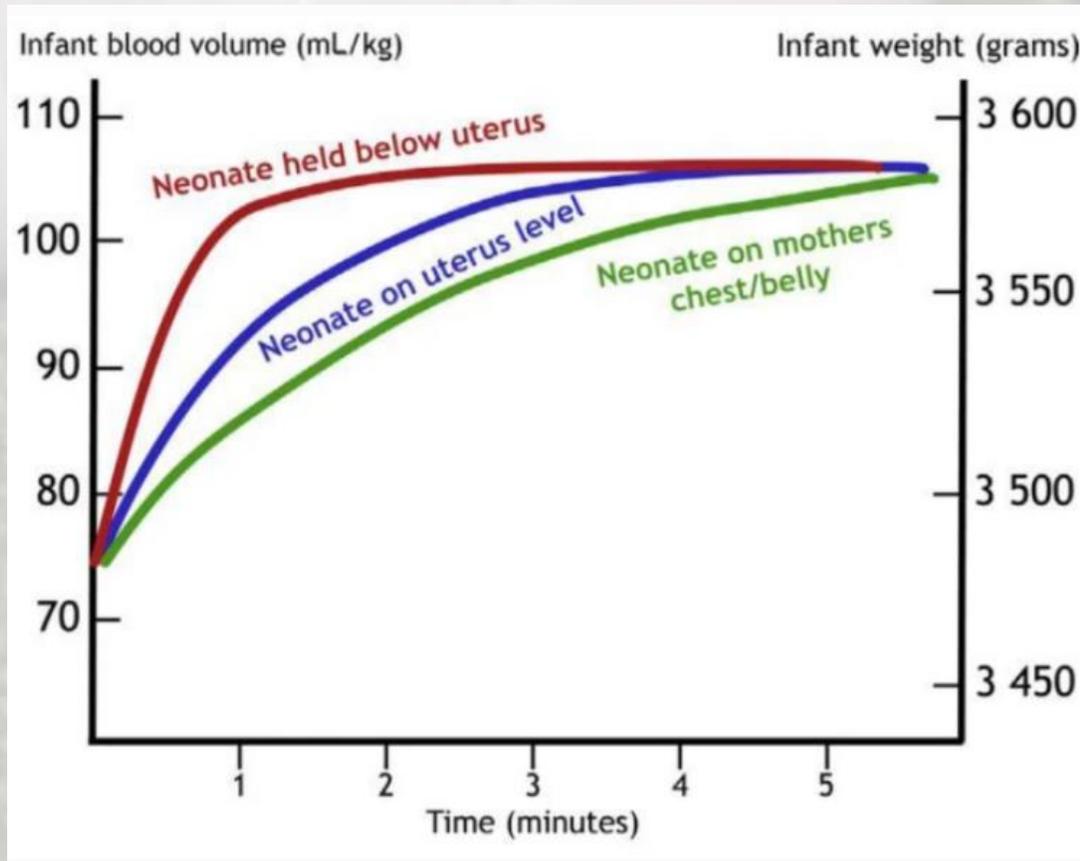
# UCM 28-32wks.

- Noninferiority randomized controlled trial USA/Canada/Germany/Ireland 2017-2022 (n-1019)
- No difference in Grade 3-4 IVH or Death
- UCM may be a safe alternative to ECC at 28-32 wks. for babies who need immediate resuscitation

# NICE (2023) – Position during DCC

- Examined 3 studies 2014 – 2020
- Argentina (120 sec)/USA (60-75 sec)/India (90sec)
- Mean reduction in hemoglobin of 0.3 g/dL for babies placed at abdominal level compared to those at vaginal level
- Different durations of DCC
- Not enough evidence to support holding the baby in a specific position

# Does positioning matter - maybe



Cord clamping at 1 minute while on mom's abdomen may decrease placental transfusion by 50%

# Jaundice & DCC

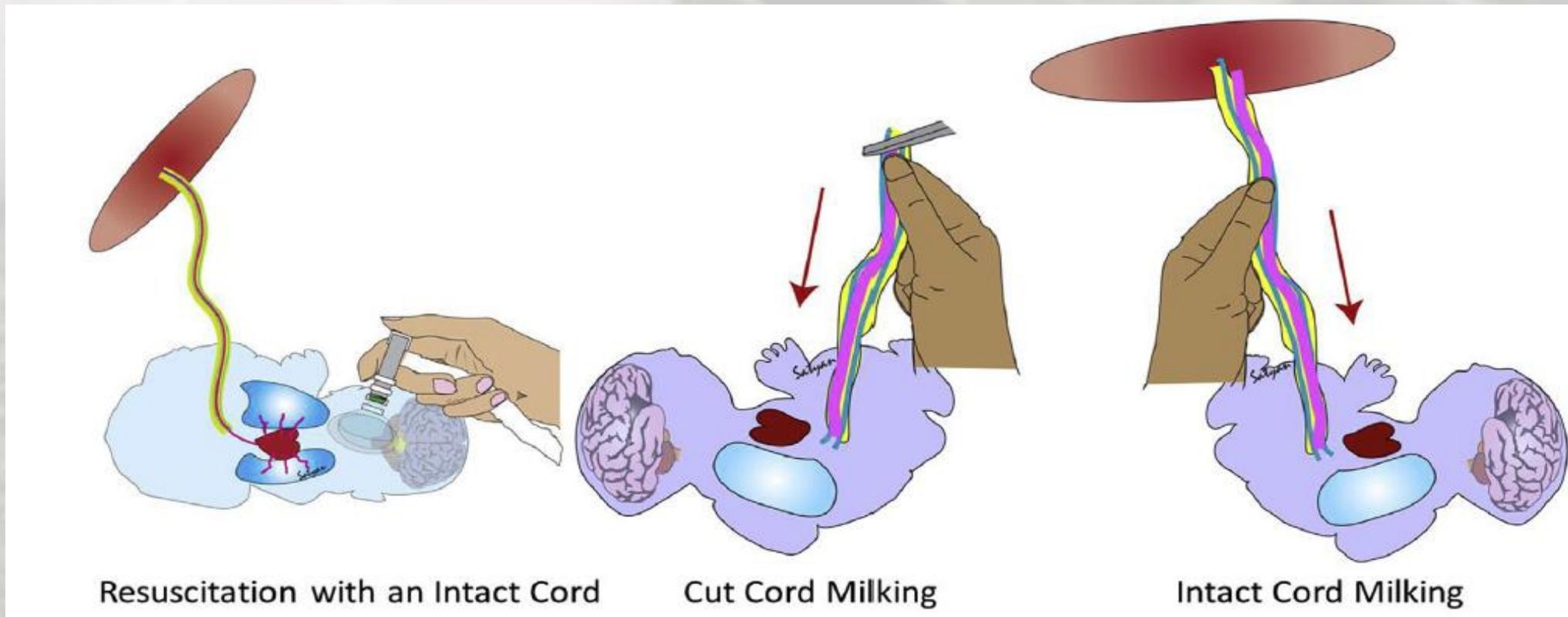
- Single-center prospective observational cohort study – 2014 (Nepal)
- Singleton neonates with gestational age 34-41 weeks (n-540)
- DCC: <60 (n-257), >180 sec (n-270)
- Transcutaneous Bilirubin and Phototherapy
- DCC not associated increased risk of Jaundice needing Phot TX

Rana N, Ranneberg LJ, Målqvist M, Kc A, Andersson O. Delayed cord clamping was not associated with an increased risk of hyperbilirubinaemia on the day of birth or jaundice in the first 4 weeks. *Acta Paediatr.* 2020

- Worth remembering that Bilirubin is powerful antioxidant....may be neuroprotective against oxidative stress.

Dore S., Takahashi M., Ferris C.D., Hester L.D., Guastella D., Snyder S.H. Bilirubin, formed by activation of heme oxygenase-2, protects neurons against oxidative stress injury. *Proc. Natl. Acad. Sci. USA.* 1999;96:2445–2450

# Deferred cord clamping - Non-vigorous





# Timing of CC for non-vigorous babies

- Research on resuscitation with intact cord ongoing

Study acronym and country	Proposed <i>N</i>	GA (weeks)	Intervention	Cord clamping time, control	Cord clamping time, intervention	Primary outcome	Expected end date
VentFirst (USA) NCT02742454 [75]	940	23–28	CPAP 30–120 s	30–60 s	120 s	IVH, HR, SpO <sub>2</sub> , Apgar scores ≤ 10 min	2024
PCI-Trial (Italy) NCT02671305 [76]	202	23–29	Resuscitation as needed	Intact UCM × 4	3 min	Composite outcome of severe IVH, CLD or death	2022
ABC2 (Netherlands Trial Registry) NTR7194 [77]	660	24–30	Resuscitation if needed	ICC	Cord clamping when stable*	Intact survival — without IVH or NEC	2024

# Resuscitation on placental circulation (RPC)

- It is feasible with the right personnel/preparation and equipment

	Clinical trials	Commercial availability	Radiant heat	Height-adjustable	Swivel function	Ability to mount additional equipment (suctioning, humidifier, pulse oximeter)	Independent gas supply	Independent electric supply
LifeStart	NRIC, Term NRIC, VentFirst Cord-Pilot, PCI-T	Yes (FDA- and CE-approved)	No, requires a chemical mattress in preterms	Yes	No	Yes	Can mount underside tanks (Europe but not in US)	No
NOOMA	No	No	No, requires a chemical mattress in preterms	Yes	Yes	Yes	Yes	Yes
Inspire	VentFirst	No	No, requires a chemical mattress in preterms	Yes	No	Yes	Yes	Yes
Concord	ABC1, ABC2, ABC3, PinC	Europe only (CE-approved)	Yes, radiant heater	Yes	Yes	Yes	Yes	No

## What we have learned.....so far

- It is feasible to commence resuscitative care following NRP guidelines from birth in preterm infants with intact placental circulation.
- Resuscitative care can be sustained for up to 120 seconds after birth while on placental circulation.

# RPC

- Can this be done for more groups of patients?
  - CDH
  - Heart disease
- Does it really work?
  - RCT's yet to be fully reported (ABC3 / VentFirst)

# Challenges with RPC

- Equipment
- Trained personnel
- Preparatory time
  - OB support/consent
  - More time and sterile equipment for CS
- Concerns relate
  - Face mask or nasal prongs may inhibit spontaneous breathing and reduce HR by vagally-mediated facial reflexes
  - Air flow may result in glottal closure via trigeminocardiac reflex and laryngeal chemoreflex
  - Face mask may trigger diving reflex with decrease in HR and  PVR

# Take home message

- DCC should be the current standard of care for newborns except in few cases
- Most guidelines recommend 30-60 sec of DCC
- Encourage spontaneous breathing for all gestations prior to cord clamping
- Cord palpation is an unreliable means of determining HR and can obstruct placental transfusion



**KEEP  
CALM  
AND  
LET ME  
BREATHE**



**I need my blood!!**

