CLAMPING DISCORD
ABOUT CLAMPING
THIS CORD

WHAT DOES THE DATA
REALLY SHOW
(IN MY MIND?!?!)

Practice Gap: Lack of knowledge of the benefits of delayed cord clamping in preterm infants vs term infants and in developing countries compared to developed countries.

Desired Outcome: Attendees will be able to differentiate the benefits of delayed cord clamping in preterm infants vs term infants and in developing countries compared to developed countries.

Would You Remove Your Child’s Kidney On The Off Chance They’ll Need It More In A Few Years Than They Do Now?

Cord blood. Designed to be baby’s first iron, stem cell and oxygen rich blood transfusion. Let them keep it.

TrimesterTalk.com
BACKGROUND

- In animals, the newborn remains connected to the placental circulation until umbilical cord spasms due to contact with the air
- This generally happens within a few minutes
- The placenta then detaches
- Many animals will eat the placenta to remove any trace of the birth
- Plus it is nutritious

BACKGROUND

- There is a similar mechanism in humans if there is no intervention
- As UA constrict, there is a net increase in blood flow from placental circulation to the fetus/newborn
- This can result in up to a 30% increase in blood volume in the newborn
- IS THIS A GOOD THING TODAY?????
WHEN AND WHY DID ALL OF THIS START?

Figure 1: Delaying cord clamping means more blood for the baby and less for the placenta.²
HISTORY

• Until the 1960's, always had DCC
• Then, there was active management of the 3rd stage of labor
• Early cord clamping, uterotonic, and gentle traction on the cord was felt to decrease length of 3rd stage
• Reduce incidence of postpartum hemorrhage
• No studies document this

WHAT DO YOU DO?

TECHNIQUE VAGINAL DELIVERY

• Hold infant 20 cm below level of placenta or introitus
• Wait at least 60 seconds if safe and no contraindications
• Could wait longer if stable
• What about skin to skin?
• Huh? Yeah, what about that?
TECHNIQUE
CESAREAN SECTION

- Deliver fetus and place on maternal lap, below the level of the uterus/placenta
- Do this for at least 60 seconds
- If safe and no contraindications, could do longer
- Diminishing return after 60 seconds

TECHNIQUE
MILKING

- Theoretically would shorten the time necessary to obtain benefits
- Concern: more rapid infusion of blood could result in cardiovascular complications
- Strip about 20 cm of cord from placenta to baby over 2 seconds
- Do this 4 times total
**TECHNIQUE MILKING**

- Total of 4 studies
  - 3 preterm
  - 1 term
- Total of about 100 patients
- Appears to be similar to routine DCC
- No increase in complications
- Limited numbers so still difficult to assess efficacy and safety

**THEORY AND SOME DATA BEHIND DCC**

THEORETICALLY IT MAKES SENSE??

**PHYSIOLOGY**

- Clamping cord results in immediate occlusion of umbilical artery and vein
- Preload to right ventricle transiently reduced
  - Up to 40%
- Left ventricular afterload immediately increases
- If infant is healthy, results in a normal and smooth transition
PHYSIOLOGY

- If newborn is compromised and has poor respiration/breathing
  - Continued high pulmonary vascular resistance
  - Persistent fetal circulation
  - Poorly oxygenated blood
  - Decreased blood returning to left ventricle
  - Decreased LV output
  - May progress and then lead to shock

BACKGROUND

- In the newborn, the increased RBC mass is unnecessary and is broken down
- Results in increased iron stores
- Results in increase in breakdown products of hemoglobin
- SOOOOOOOOOOO??????

DCC Before and After Ventilation Onset*

*Using preterm lambs, Bhatt et al compared effects of ventilation before and after cord clamping.

"Delayed cord clamping allows time for the infant to aerate its lungs and increase pulmonary blood flow (PBF) before venous return from the placental circulation is lost."

"...It avoids large swings in cardiovascular function."

IT’S WHAT’S FOR DINNER!!!!

BACKGROUND
• In animals, iron deficiency has been shown to be involved with
  – Dopamine metabolism
  – Myelination
  – Energy metabolism
• In humans, suggestion ID has been associated with
  – Impaired neurodevelopment
    • Gross movement
    • Fine movement
  – Behavior issues

BACKGROUND
• In some humans studies, iron replacement in high risk populations has
  – Improved psychomotor function
  – Behavior issues
• Mostly seen in developing countries
• What about in the U.S.
IRON DEFICIENCY

- Multiple ways to determine this
  - H/H
  - MCV
  - Ferritin level
  - Transferrin saturation
  - Reticulocyte count
- Often times, babies only screened for anemia but not the etiology

IRON DEFICIENCY IN INFANTS

- Lower math scores
- Lower performance on most cognitive tests
- More behavioral issues reported by parents
- Slower auditory evoked response on hearing tests
- Only thing that correlates with adverse infant outcome is ID anemia (not subtle, subclinical iron deficiency)

IRON DEFICIENCY: Does it cause developmental issues?

- CDC states this is unclear and not necessarily causal
- Most studies are cross sectional population based that are not well controlled for other important variables
- Improving iron status does not always improve scores/behavior
IRON DEFICIENCY:  
Does it cause developmental issues?
• Many of studies did not specifically look at iron deficiency as the cause of the anemia
• Didn’t check for deficiencies in other micronutrients (zinc, iodide)
• Socioeconomic status
• Parenteral education
• Pregnancy complications

I ❤️ CORDS!!!

BACKGROUND
• Is there a neonatal trade-off(s)???
  – Untreated/undertreated jaundice
  – Hyperviscosity syndrome
  – Inadvertent cord avulsion during waiting period
  – Cord blood banking
• Are there maternal concerns?
  – Postpartum hemorrhage
• Can you do cord gases after DCC???
BACKGROUND

• Groups that may benefit
  – Premature
  – Birth depression (?)
    • Think EXIT procedure
• Does this extrapolate to
  – Uncomplicated term deliveries in an affluent society where ID is rare
• So, what does the data show

BENEFITS IN PRETERM

• Improved H/H
• Improved blood pressure
• Increased blood volume
• Improved myocardial function
• Increased urine output
• Decreased need for blood transfusion
• Decrease in all grades of IVH and NEC
• NNT for all of the above is about 10
BENEFITS AT TERM

- Higher H/H
- Higher total body iron stores at 2 & 4 months of age
- Higher ferritin levels at 2 & 4 months of age
- Less iron deficiency anemia at 4 & 6 months of age

STUDIES SUGGEST ??

- Increased RV output
- Increased RV stroke volume
- Increased SVC blood flow suggesting increased cerebral perfusion
- Improved neonatal transition
  - Better Apgars
  - Increased blood pressure
  - Increased urine output
  - Improved feeding success

<table>
<thead>
<tr>
<th>Benefits at Term</th>
<th>Pre-term/low birth weight infants</th>
<th>Full-term infants</th>
<th>Mothers</th>
<th>Pre-term/low birth weight</th>
<th>Full-term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate benefits</td>
<td>Increased RV output</td>
<td>Increased RV stroke volume</td>
<td>Increased SVC blood flow</td>
<td>Improved neonatal transition</td>
<td>Better Apgars</td>
</tr>
<tr>
<td>Long-term benefits</td>
<td>Increased RV output</td>
<td>Increased RV stroke volume</td>
<td>Increased SVC blood flow</td>
<td>Improved neonatal transition</td>
<td>Better Apgars</td>
</tr>
</tbody>
</table>

Table 1: Summary of immediate and long-term benefits of delayed umbilical cord clamping for infants (term, pre-term/low birth weight) and mothers
ALL THIS MAKES SENSE RIGHT?

BUT WHAT ABOUT IN CLINICAL PRACTICE?

EFFECT OF DCC ON VLBW INFANTS

- NICHD 3 center trial with 33 infants randomized to DCC (16) vs ECC (17)
- Primary outcome: hematocrit at 4 hours of life
- A bunch of secondary stuff was looked at
- Results: Hematocrit was higher at 4 hour. No difference in BP, need for transfusion, or hematocrit at 2, 4, or 6 weeks of age
- Conclusion: Higher hematocrit suggests effective placental transfusion

Oh W et al J Perinatol 2011;31:S68-S71
HEMODYNAMICS OF DCC IN PREMATURE INFANTS

- Secondary analysis of earlier trial
- 25 in DCC and 26 in ECC from 24-31 weeks
- Doppler studies of SVC, RV output, MCA, SMA, LV shortening fraction, and PDA
- Results: Higher blood flow in SVC and higher RV output and stroke volume up to 48 hours
- Conclusion: DCC is associated with potentially beneficial hemodynamic changes in first days of life

Sommers R et al. Pediatrics 2012;129:e667-e672

Delayed Cord Clamping in Very Preterm Infants Reduces the Incidence of Intraventricular Hemorrhage and Late-Onset Sepsis: A Randomized, Controlled Trial

Judith S. Mercer, DNSc

- 72 pairs at < 32 weeks randomized to DCC (30-45 sec) vs ICC (5-10 sec)
- Primary outcome: BPD and NEC
- No difference in demographics
- No difference in primary outcome
- Lower incidence of all IVH in DCC group but no difference in severe (grade 3 or 4)
- Trend towards less sepsis and higher H/H in DCC group

Pediatrics Vol. 117 No. 4 April 1, 2006 pp. 1235 -1242

UCM VS. DCC IN PRETERM INFANTS

- 2 center RCT comparing UCM vs DCC in preterm (< 32 weeks) delivered by c-section
- UCM was 4 strips over 20-30 secs
- DCC was for 45 sec
- Total of 154 infants
- Mean gestational age in both groups = 28 wks
- Looked at lots of stuff!!!

UCM VS DCC IN PRETERM INFANTS

- In the UCM group, findings were
  - Higher SVC flow
  - Higher RV output in the first 12 hours
  - Higher hemoglobin
  - Higher delivery room temperature
  - Higher blood pressure over first 15 hours
  - Higher urine output in first 24 hours

Anup KC et al Pediatrics July 2015:136(1);61-69

IS DOING BOTH, UCM & DCC BETTER THAN JUST DCC

- RCT of babies between 22 and 32 weeks delivered by c-section
- Compared DCC for 30 sec to DCC with the addition of cord stripping for 4-5 times
- 67 total infants with 32 in DCC and 37 in UCM
- Looked at a lot of short term stuff
- Looked at as a whole and in pre and post 28 week EGA

Krueger MS et al AJOG March 2015:212;394.e1-5

IS DOING BOTH, UCM VS DCC, BETTER THAN JUST DCC

- Study found no difference in
  - Mean hemoglobin
  - Units of blood transfused
  - Days on ventilator
  - Length of stay
- ? Trend towards higher hemoglobin in those under 28 weeks, not statistically significant

Krueger MS et al AJOG March 2015:212;394.e1-5
COCHRANE REVIEW
PRETERM DELIVERY

- Evaluated 10-15 studies (depending on the desired outcome) 24-36 weeks
- Total of 500+ to 700+ infants
- DCC had
  - Lower incidence of IVH (all grades)
  - NEC
  - Need for transfusion
  - Higher peak bilirubin
- No difference in death, severe IVH, or PVL

Authors' conclusions
Providing additional placental blood to the preterm baby by either delaying cord clamping for 30 to 120 seconds, rather than early clamping, seems to be associated with less need for transfusion, better circulatory stability, less intraventricular haemorrhage (all grades) and lower risk for necrotising enterocolitis. However, there were insufficient data for reliable conclusions about the comparative effects on any of the primary outcomes for this review.
**IS DCC CLINICALLY FEASIBLE?**

- Retrospective cohort control
- Protocol for DCC developed and implemented for EGA < 32 weeks
- Evaluated DCC performed for 1 year and compared to prior year
- Multiple exclusion criteria

Chiruvolu A et al. AJOG 2015;213:676.e1-7

**IS DCC CLINICALLY FEASIBLE**

- Of 60 eligible patients, all received DCC (100%)
- Compared to 88 historic controls, matched for EGA, maternal factors, mode of delivery..
- Delayed cord clamping had
  - Less intubation
  - Less transfusion
  - Less RDS
  - Less surfactant
  - Less grade 1 & 2 IVH

Chiruvolu A, et al. AJOG 2015;213:676.e1-7
EFFECT OF DCC ON NEURODEVELOPMENT AND INFECTION AT 4 MONTHS

- 382 infants randomized to DCC vs ECC
- Ages and Stages Questionnaire, IgG, and parents reported symptoms of infection at 4 months
- Results: No difference in IgG levels or parents reported symptoms. No difference in neurodevelopment except possibly improved problem solving (at 4 months???) and lower mean score in personal-social domain (???) in DCC group
- Conclusion: no significant differences

Andersson O  ACTA Paediatrica 2013;102:525-531

EFFECT OF DCC VS. ECC ON IRON AND NEURODEVELOPMENT AT 12 MONTHS

- 347 term infants randomized to ECC (< 10 sec) vs DCC (180 sec) at a Swedish community hospital
- At 12 months: ferritin level, transferrin saturation, transferrin receptor level, hemoglobin, MCV
- Some sort of developmental score
- Findings: No difference between groups. Predictors of development was female sex and early breastfeeding. Predictors of ferritin level was female sex and cord ferritin levels

Andersson O et al JAMA Pediatric 2014;168(6):547-554

COCHRAN REVIEW TERM DELIVERY

- 15 trials looking at 3900+ couplets
- Moderate risk of bias
- No difference in EBL or postpartum hemorrhage
- Neonatal outcomes in DCC
  - Higher birth weight (???)
  - More need for phototherapy
  - Higher H/H at 1 and 2 days of life (not significantly different at any other time)
  - Less iron deficiency
  - No difference in development
COCHRAN REVIEW
TERM DELIVERY

• Authors' conclusions

A more liberal approach to delaying clamping of the umbilical cord in healthy term infants appears to be warranted, particularly in light of growing evidence that delayed cord clamping increases early haemoglobin concentrations and iron stores in infants. Delayed cord clamping is likely to be beneficial as long as access to treatment for jaundice requiring phototherapy is available.

DELAYED CORD CLAMPING

EFFECT OF DCC ON CORD GASES AND POSTPARTUM HEMORRHAGE

• 4 studies looking at blood gases with DCC
• Opposite conclusions
  – 2 demonstrated lower pH, decrease in base excess and higher pCO2
  – 2 found no change or higher pH
    • Valero and Wiberg with lower pH
    • De Paco and Andersson found no change
• No studies found increase in maternal blood loss or postpartum hemorrhage
POTENTIAL CONTRAINDICATIONS

- Multiple gestations
- Fetus already at risk for polycythemia
- Maternal viral infections
- Bleeding such as abruption or previa
- Effects on cord gases or cord blood banking
- Need for immediate resuscitation at least in term infants
- Various anomalies

Don’t cut my cord too soon!
Waiting at least 2 minutes:
- Gives me around 32% more blood volume
- Increases my iron reserve 27–47 mg
- Reduces my risk of anemia and blood transfusions
- Reduces my risk of intraventricular haemorrhage
- Supplies me with oxygen

Things I find amusing!
WHAT IS EVERYONE SAYING?
PROFESSIONAL SOCIETIES

• WHO: In preterm, delay cord clamping for 30-120 secs. In term, up to 3 minutes

• SOGC: delay cord clamping for at least 60 seconds for preterm birth

• European Association of Perinatal Medicine: delay cord clamping 30-45 seconds with baby below the mother

• International Liaison Committee on Resuscitation: delay cord clamping for at least 1 minute in babies not requiring resuscitation

• ACOG: Evidence supports DCC in preterm for 30-60 secs. Insufficient evidence to support or refute it in term infants especially in settings with rich resources
WHAT DOES ALL THIS MEAN?

- I have no idea!!!!!!
- I don’t think anyone does either!!!!!!
- Appears to be beneficial and feasible to do in preterm kids
- Doubt that it is helpful in term babies in resource rich countries but most likely not harmful.
- I think it should be a policy for EGA < 34 wks

WHAT DOES ALL THIS MEAN?

- Be careful in patients at high risk for polycythemia/hyperviscosity, anemia, twins especially monochorionic....
- Ask resuscitation team for their preference, I guess
- Concerned about confusion on alteration in cord gases
- I am sure this will all change soon!!!!!!

QUESTIONS?

THANK YOU!