

## TWO STEP DELIVERY REDUCES SHOULDER DYSTOCIA

A belief that prolonged head-to-body delivery interval endangers the newborn underpins the common obstetrical practice of delivering the baby's trunk immediately after the head is born. Without intervention, however, birth typically occurs in two steps: once the fetal head is delivered there is usually a pause, and the rest of the infant is born with the next contraction. Dr. Kotaska will discuss evidence showing that a two-step delivery does not increase the risk of fetal harm, may lower the incidence of shoulder dystocia, and should be considered physiologically normal, with implications for the definition of shoulder dystocia.

1. Describe the physiological mechanism of birth of the fetal trunk 2. Explain the mechanics and hemodynamics of shoulder dystocia 3. Explain the acid-base physiology of neonatal hypoxic encephalopathy caused by shoulder dystocia 4. Incorporate physiological two-step delivery into a definition of shoulder dystocia

# Two-step delivery: Head to Body Interval & Shoulder Dystocia

4<sup>th</sup> Northern Perinatal Conference  
Smithers, B.C. Sept 17<sup>th</sup>, 2016

Andrew Kotaska MD, FRCSC  
Yellowknife, NT, Canada

## Objectives

- Describe one-step vs. two-step delivery
- Discuss the role of Head to Body Interval (HBI) in neonatal outcome
- Explain the relationship between cord gases and HIE in shoulder dystocia
- Review the definition of shoulder dystocia
- Explore the concept of auto-resuscitation

## “One-step”

“Most often, the shoulders appear at the vulva just after external rotation and are born spontaneously. If delayed, immediate extraction may appear advisable. The sides of the head are grasped with two hands, and gentle downward traction is applied until the anterior shoulder appears under the pubic arch.”

William's Obstetrics, 23<sup>rd</sup> Ed.

## “Two-step”

“Once crowned, the head is born by extension. . . . During the resting phase before the next contraction, the midwife may check that the cord is not around the baby's neck . . . . Restitution and external rotation of the head maximizes the smooth birth of the shoulders . . . .”

Myles Midwifery 15<sup>th</sup> Ed.

## Which way?

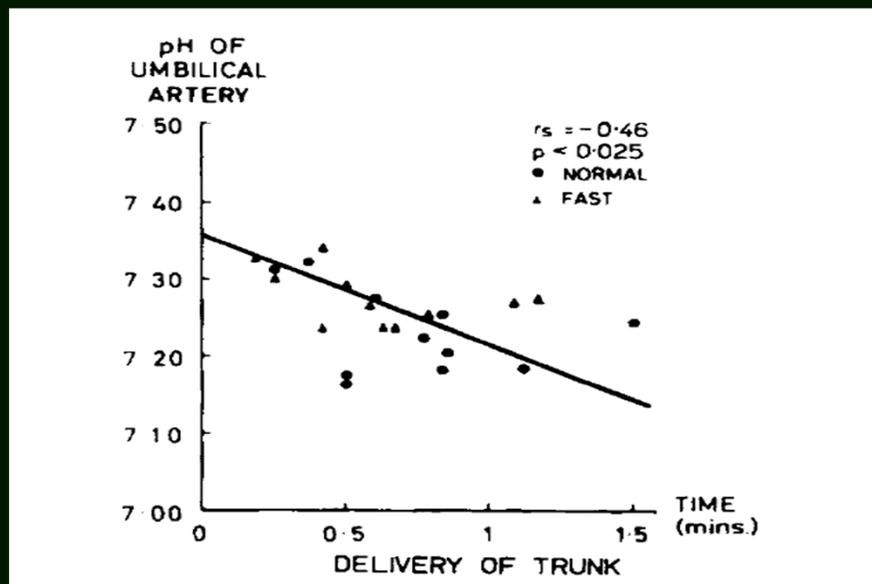


## Head to Body Interval (HBI), a one-step approach (1973)

Wood et. al. randomized 22 women to:

- “Rapid delivery:” early episiotomy, directed pushing, supine-lithotomy, early forceps for any delay, versus
- “Normal delivery” (not described)

Wood C, Ng K, Hounslow D, Benning H. Time, an important variable in normal delivery. *J Obstet Gyneacol Br Comm* 1973;80(4);295-300.



Wood C, Ng K, Hounslow D, Benning H. Time, an important variable in normal delivery. *J Obstetr Gyneacol Br Comm* 1973;80(4);295-300

## Wood's (1973) Conclusion:

“(an) upper time limit of ... 40 seconds for delivery of the trunk (is) ideal... Unless the obstetrician can be certain that the fetus is in good condition, it may die or suffer brain damage from added asphyxia as a result of delay during normal birth.”

## HBI & Shoulder Dystocia

- Retrospective audit of 200 S.D. births:
  - Risk of HIE with HBI < 5 min = 0.5%
  - Risk of HIE with HBI  $\geq$  5 min = 23.5%

Leung T, et al. BJOG 2011;118:474–479

## HBI & Shoulder Dystocia

- UK Confidential Enquiry into shoulder dystocia deaths:
  - 35/56 had HBI 5 minutes or longer
  - 21/56 had HBI **less than 5 minutes**

Hope P. et al. BJOG 1998;105:1256–61.

## Shoulder Dystocia Definition

## Shoulder Dystocia Definition

Spong et al. An objective definition of shoulder dystocia: Prolonged head-to-body interval and/or the use of ancillary obstetric maneuvers. *Obstet Gynecol* 1995;86:433–6

HBI > 60 seconds **alone** suggested as an objective criteria for shoulder dystocia.

## Worry & Hurry

- If head doesn't deliver right away, it could be SD.
- In SD, increased HBI = poorer outcome.
- Increased HBI must be dangerous in every birth.

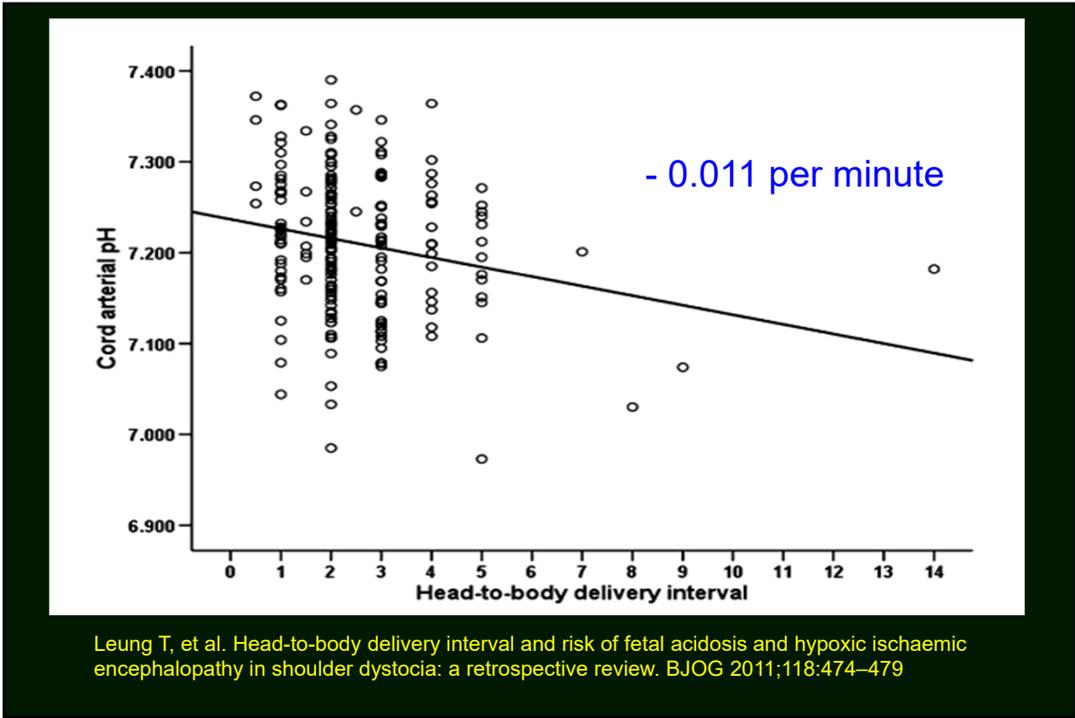
### Conclusion:

→ Better deliver the body immediately after the head in every birth, just in case.

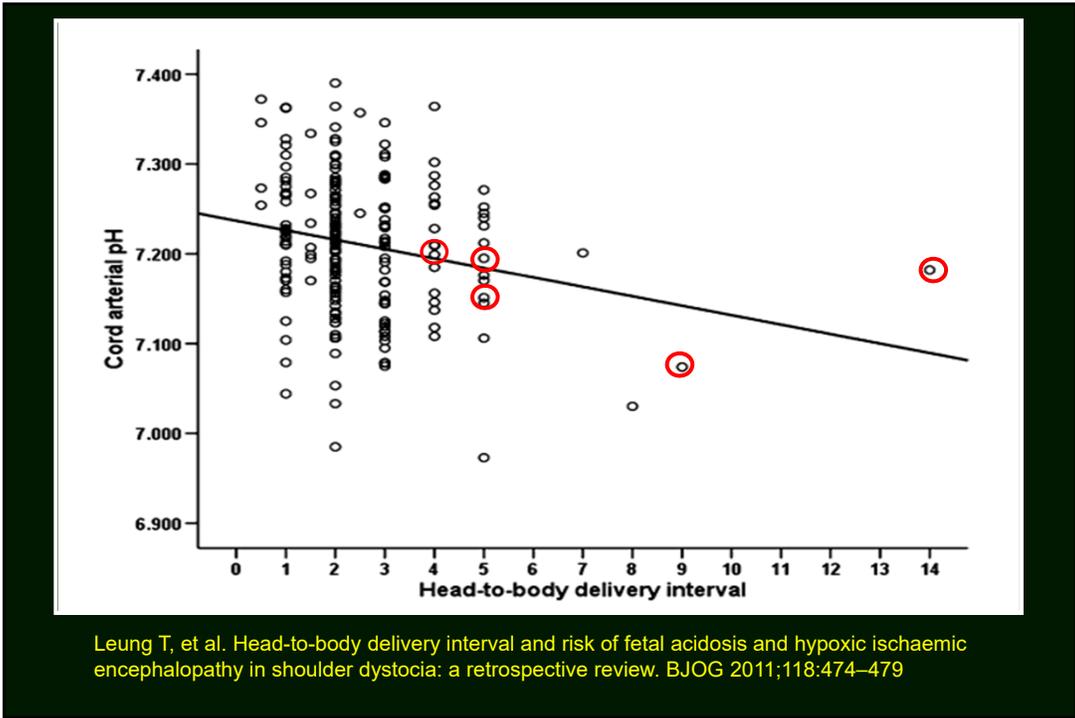
## HBI & Shoulder Dystocia

- Retrospective audit of 200 S.D. births:
  - Risk of HIE with HBI < 5 min = 0.5%
  - Risk of HIE with HBI  $\geq$  5 min = 23.5%

Leung T, et al. BJOG 2011;118:474–479



Leung T, et al. Head-to-body delivery interval and risk of fetal acidosis and hypoxic ischaemic encephalopathy in shoulder dystocia: a retrospective review. BJOG 2011;118:474–479



Leung T, et al. Head-to-body delivery interval and risk of fetal acidosis and hypoxic ischaemic encephalopathy in shoulder dystocia: a retrospective review. BJOG 2011;118:474–479

**Table 4.** Clinical details of the five cases suffering from hypoxic ischaemic encephalopathy (HIE)

Case	Parity	Gestation (weeks)	DM	Nonreassuring fetal heart rate pattern	Mode of delivery	HBDI (minutes)	Birth weight (kg)	Art. pH	Art. BE	Ven. pH	Ven. BE	AS5	HIE	Outcome
1	0	39	No	No	Instrumental	5	4.285	7.151	-15.20	7.155	-14.40	5	1	Recovered
2	0	40	No	Yes	Instrumental	4	3.940	7.199	-9.20	7.233	-9.40	8	1	Recovered
3	0	41	No	No	Instrumental	5	3.560	7.195	-7.20	7.245	-8.20	2	1	Recovered
4	0	41	No	No	Instrumental	9	4.360	7.074	-8.60	7.268	-4.30	0	1	Recovered
5	1	39	No	No	Instrumental	14	3.635	7.182	-9.50	7.197	-10.30	0	2	Died 3 years

Art., arterial; AS5, Apgar score at 5 minutes; BE, base excess; DM, diabetes; HBDI, head-to-body interval; Ven., venous.

Leung T, et al. Head-to-body delivery interval and risk of fetal acidosis and hypoxic ischaemic encephalopathy in shoulder dystocia: a retrospective review. *BJOG* 2011;118:474–479

## HBI & Shoulder Dystocia

- Case series of 8000+ births
- 134 cases of shoulder dystocia compared with the general obstetric population
- HBI was not associated with a ... change in cord pH.

Stallings et al. Correlation of head-to-body delivery intervals in shoulder dystocia and umbilical artery acidosis. *Am J Obstet Gynecol* 2001;185:268-74

## HBI & Shoulder Dystocia

- Among cases lasting  $\geq 3$  min., mean pH = 7.26
- Among cases of neonatal injury, mean pH = 7.23
- Among cases requiring  $> 2$  maneuvers, cord pH was also normal

Stallings et al. Correlation of head-to-body delivery intervals in shoulder dystocia and umbilical artery acidosis Am J ObstetGynecol 2001;185:268-74

## Perinatal Asphyxia

- Arterial cord pH  $< 7.0$
- Arterial cord base deficit  $> 12$  (16)
- Early evidence of moderate to severe hypoxic neurological injury (eg. seizures)
- Evidence of multiple organ system hypoxic injury

## How does shoulder dystocia cause fetal brain damage despite normal cord gases?

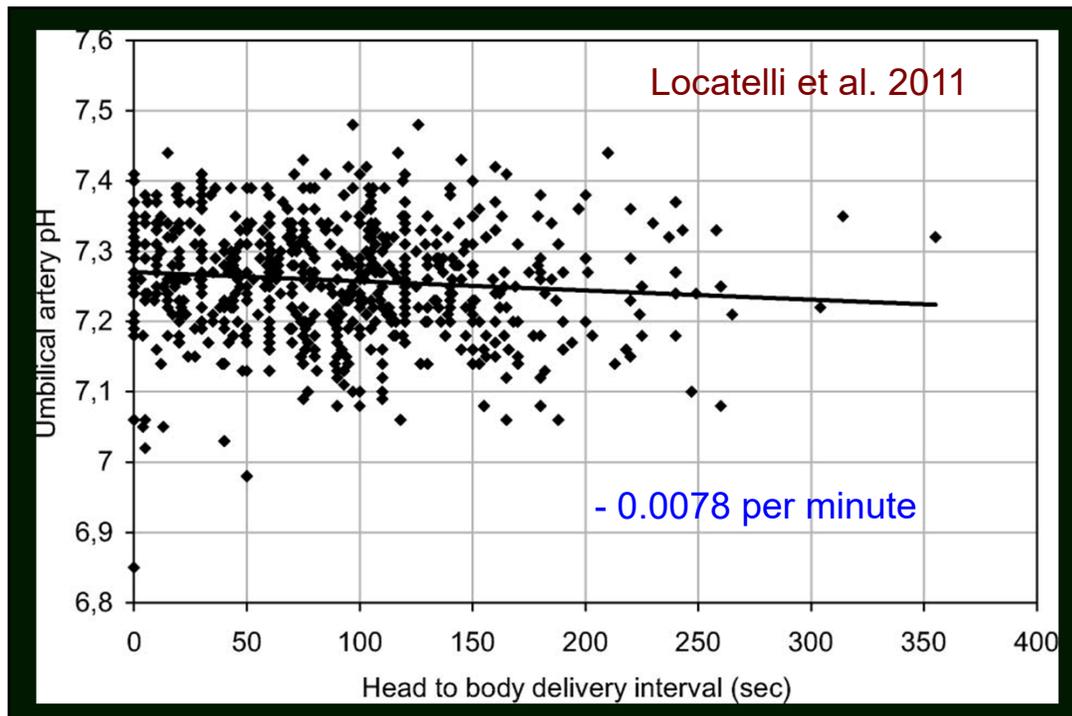
### Two-step delivery (Locatelli et al. 2011)

- Prospective study of HBI in 1231 vaginal births
- Followed maternal urge to push in position of choice
- Awaited restitution without manipulation following delivery of the head
- Waited for next uterine contractions to accomplish spontaneous delivery of the shoulders & body
- Turtle sign observed in 15 cases →
  - Prophylactic McRoberts position
  - Shoulders spontaneously delivered with maternal effort with next contraction in 15/15

## Two-step delivery (Locatelli et al. 2011)

- Mean HBI was 88 s +/-60 s
  - Only 20% delivered head and body in 1 contraction
  - In 15 women, HBI was > 4 minutes (max = 6 min)
  - Cord pH not altered by the head to body interval
  - Shoulder dystocia in 3/1231 = 0.24% (very low)
  - 2 of 3 SD occurred in precipitous births
- Two-step approach may reduce the incidence of shoulder dystocia.

Locatelli, A. et al. Head-to-body delivery interval using "two-step" approach in vaginal deliveries: effect on umbilical artery pH. J Mat Fet Neonat Medicine 2011;24(6): 799-802(5)



## Normal Birth ≠ Shoulder Dystocia

Rushing delivery of the fetal body may interfere with normal restitution, possibly increasing likelihood of SD

## Summary

- Allowing a physiological pause between delivery of head and body is not harmful because intrauterine pressure is low. (\*caveat)
- Two-step delivery may prevent SD.
- If delivery not accomplished spontaneously with next contraction, SD is present.
- If SD, don't PANIC, PULL, or PUSH → relaxed uterus between contractions will maximize fetal cerebral perfusion and enhance effectiveness of maneuvers to relieve SD.

## \*Caveat

An abnormal FHR is evidence of fetal compromise

→ fetal status is deteriorating!

**One-step delivery is indicated!**

**Two-Step Delivery May Avoid Shoulder Dystocia: Head-to-Body Delivery Interval Is Less Important Than We Think.**

J Obstet Gynaecol Can 2014;36(8):716–720

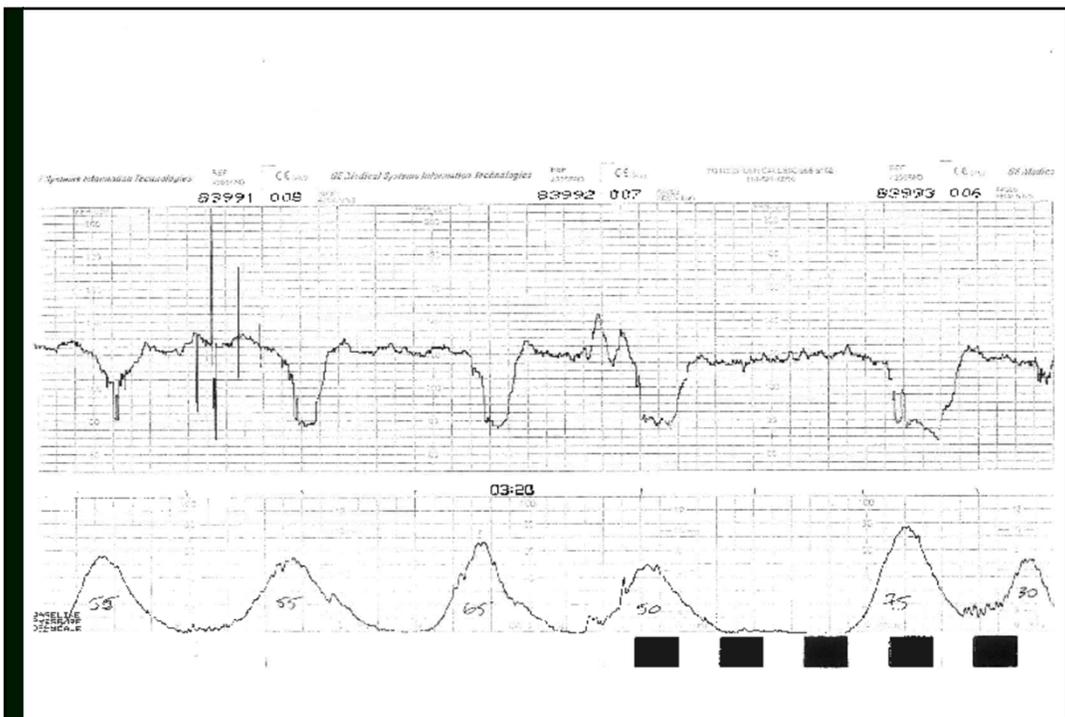
Andrew Kotaska, MD, FRCSC

Kim Campbell, RMRN, MN

# Questions?

## Acid-base physiology: case 1

- Healthy 25 y/o G<sub>2</sub>P<sub>1</sub> @ 40 weeks gest<sup>n</sup>
- Spontaneous normal labour; normal IA
- Deep variable decelerations late 2<sup>nd</sup> stage, with good recovery
- Terminal bradycardia x 6 minutes
- Tight nuchal cord – delivered through loop
- Flat baby
- Cord gases?



## Umbilical cord artery

A:

- pH = 6.99
- pCO<sub>2</sub> = 90
- BD = 4
- Lactate = 4

B:

- pH = 6.99
- pCO<sub>2</sub> = 51
- BD = 12
- Lactate = 11

## Acid-base physiology: case 2

- Healthy 32 y/o G<sub>1</sub> at 38 weeks gestation
- Frank breech presentation
- Normal spontaneous labour; good progress
- 45 minute 2<sup>nd</sup> stage; mild variable decels
- Fetus born to umbilicus, then 4 minute delay
- Delivery with IV oxytocin and turn to all-4's
- Flat baby
- Cord gases?

## Acid-base physiology: Respiratory acidosis

### Umbilical artery

- pH = 6.99
- pCO<sub>2</sub> = 90
- BD = 4
- Lactate = 4

### Umbilical vein

- pH = 7.32
- pCO<sub>2</sub> = 44
- BD = 3
- Lactate = 3

## Acid-base physiology: Metabolic acidosis

### Umbilical artery

- pH = 6.99
- pCO<sub>2</sub> = 51
- BD = 12
- Lactate = 11

### Umbilical vein

- pH = 7.12
- pCO<sub>2</sub> = 45
- BD = 10
- Lactate = 9

## Acid-base physiology: cases 1 & 2

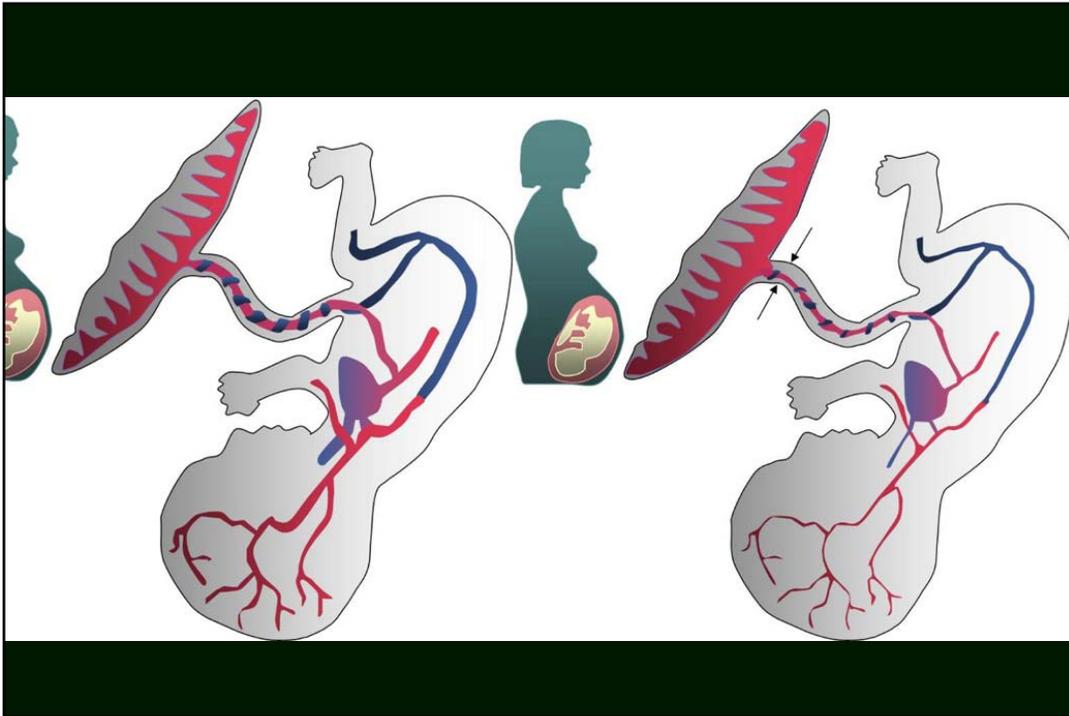
- Delivery of flat baby;
- Cord clamped immediately;
- Baby to Paediatrician & resuscitation bay;

## Acid-base physiology: cases 1 & 2

- Delivery of flat baby;
- Cord clamped immediately;
- Baby to Paediatrician & resuscitation bay;
- Successful resuscitation with PPV;

## Acid-base physiology: cases 1 & 2

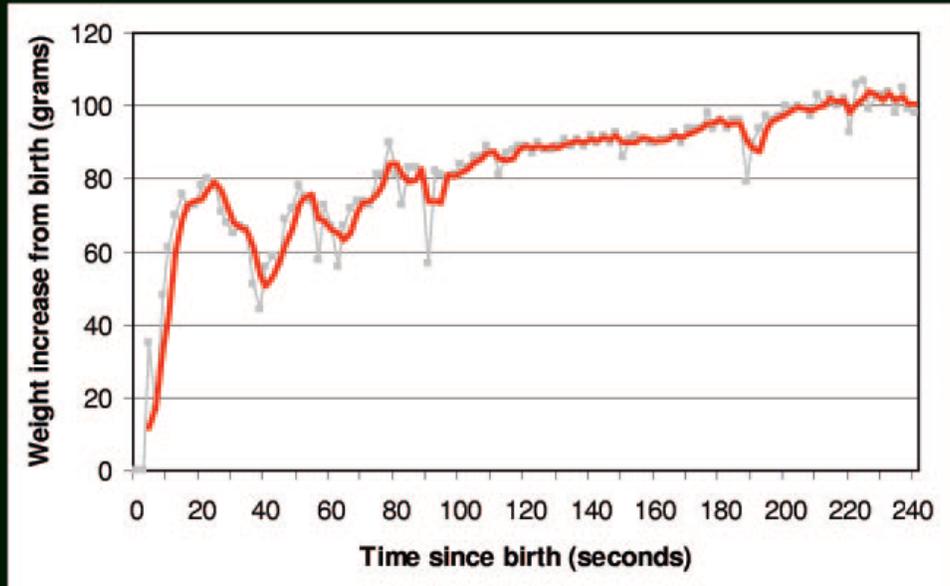
- Delivery of flat baby;
- Cord clamped immediately;
- Baby to Paediatrician & resuscitation bay;
- Successful resuscitation with PPV;
- Slow transition – **Why?**



## Auto-transfusion: more than just iron stores

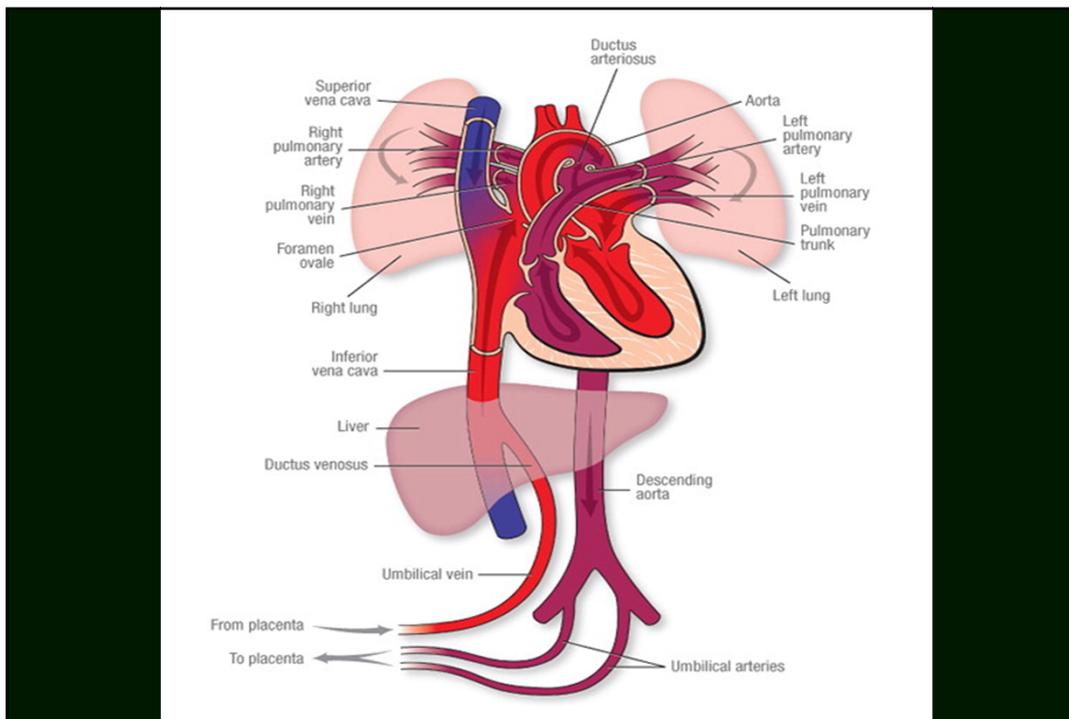
- Delaying cord clamping 1 minute allows 50-80 cc auto-transfusion from placenta to fetus, or 15-25 ml per kg birth weight, *in a normal birth*.
- The proportionate equivalent in an adult would be 1 L of whole blood

## Placental Transfusion (Diaz Rosello)



## Fetal Circulation





## Auto-resuscitation

- If fetal metabolic acidosis is absent, residual placental blood is well-oxygenated, contains little  $\text{CO}_2$ , and has a normal pH.
- Auto-transfusion improves brain and cardiac perfusion and function within seconds

## Auto-transfusion: benefits

- Auto-resuscitation from respiratory acidosis
- Hemodynamic filling of pulmonary vasculature → improved transition
- Improved iron stores
- Decreased infant anemia

## Auto-transfusion: harms?

- Insufficient blood for arterial cord gas analysis or cord blood banking
- Delays resuscitation measures - **unless** logistical modifications to allow NRP with cord intact for 1 minute



## Intact Cord Resusc 3.0

Bedside Assessment, Stabilisation and Initial Cardio respiratory Support (BASICS) mobile trolley at Liverpool Womens' Hospital

## Pediatric iPhone 8

(aka: LifeStart  
Neonatal  
Resuscitation  
Unit)



“Clamping the functioning umbilical cord at birth is an unproved intervention”



David J R Hutchon

## DCC Benefits – Term Infants

**Table 1** Benefits of delayed cord clamping for term infants

---

**Term infants >37 weeks**

---

Delaying cord clamping for at least one minute

Higher early hemoglobin concentration

Increased iron reserves up to 6 months after birth

No difference in PPH rates

Higher birth weight

No statistically significant increase in jaundice or polycythemia

---

Abbreviation: PPH, post partum haemorrhage.

# DCC Benefits – Preterm Infants

**Table 2** Benefits of delayed cord clamping for preterm infants

**Preterm infants 24–37 weeks**

Providing additional placental blood to the preterm baby by delaying cord clamping by 30–120 seconds resulted in

Fewer babies needing transfusions for anemia

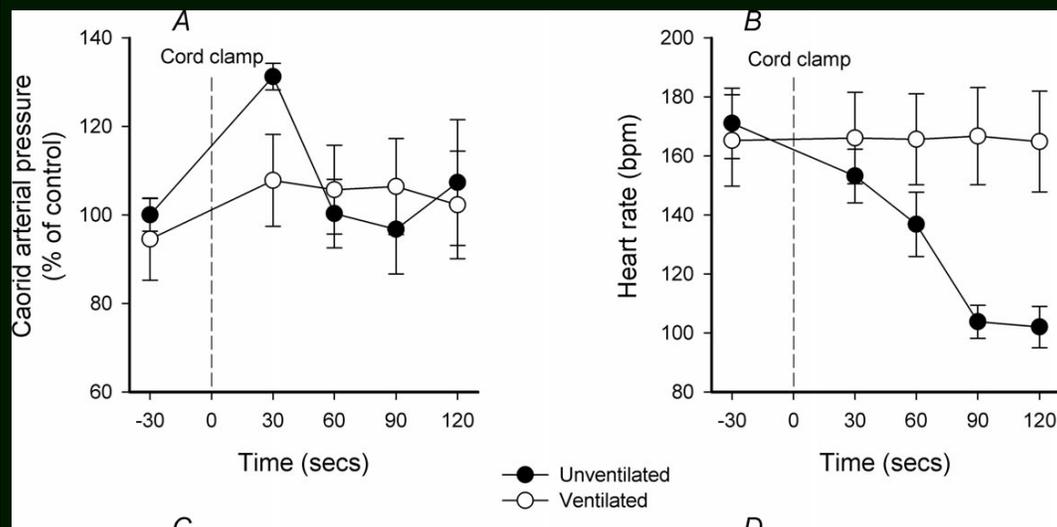
Better circulatory stability

Reduced risk of intraventricular hemorrhage (all grades)

Reduced risk of necrotizing enterocolitis

Reduced late-onset sepsis

# Fetal Lamb Physiology



# Dispensing with Dogma

- Early cord clamping is an intervention.
- Early cord clamping was instituted without evaluation or evidence.
- The onus is on proponents of early cord clamping to demonstrate that it does not cause harm – also for depressed infants.

“In 2010, the International Liaison Committee on Resuscitation recommended that UCC be delayed for at least 1 min in healthy term infants not requiring intervention...

it is recommended that the asphyxic infant (be) separated from the placenta and transferred to a resuscitation table for urgent resuscitation, although this recommendation is not based on scientific or clinical evidence.

Indeed, it could be argued that these infants would receive the greatest benefit from DCC, especially if delayed until respiration is initiated.”

(Bhatt et al. Frontiers in Pediatrics 2014)

## Non-evidence-based interventions

- ~~• Routine enema & shave prep~~
- ~~• Delivery in operating room~~
- ~~• Prophylactic forceps~~
- ~~• Routine episiotomy~~
- ~~• Routine neonatal suction~~
- ~~• Suction below cords (meconium)~~
- One-step delivery
- Early cord clamping

## Acid-base physiology: Umbilical cord artery

### Respiratory acidosis

- pH = 6.99
- pCO<sub>2</sub> = 90
- BD = 4
- Lactate = 4

### Metabolic acidosis

- pH = 6.99
- pCO<sub>2</sub> = 51
- BD = 12
- Lactate = 11

# Acid-base physiology:

## Umbilical cord vein

### Respiratory acidosis

- pH = 7.32
- pCO<sub>2</sub> = 44
- BD = 3
- Lactate = 3

### Metabolic acidosis

- pH = 7.12
- pCO<sub>2</sub> = 45
- BD = 10
- Lactate = 9

## Dispensing with Dogma

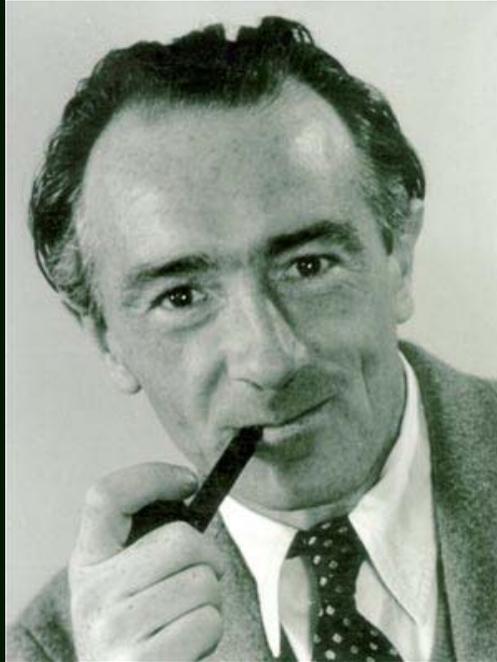
- One-step delivery is an intervention.
- One-step delivery was instituted based on faulty interpretation of poor evidence.
- The onus is on proponents of one-step delivery to demonstrate that it does not cause harm and improves clinically relevant outcome.

## Delayed Cord Clamping Harms

- Higher rates of hyper-bilirubinemia (jaundice) in both term and preterm infants – did not lead to a significant increase in need for phototherapy.
- Higher incidence of polycythemia (venous Hct >65%) but no infants were found to develop related symptoms or complications

## Autorange-Resuscitation

Oxygenated placental blood → Umbilical vein  
→ ductus venosus → inferior vena cava  
→ right atrium  
→ foramen ovale  
→ left atrium → left ventricle  
→ pre-ductal aorta  
→ carotid & coronary arteries  
→ **FETAL BRAIN & HEART**



Archie Cochrane  
1909-1988

“He was always ready to challenge medical (and non-medical) authorities to provide better evidence about the basis for their diagnoses and treatments.”

- Iain Chalmers 2006

## Evidence-based obstetrical successes:

- Corticosteroids for premature fetal lung maturation
- Magnesium sulfate for pre-eclampsia
- Ecbolics for post-partum hemorrhage
- Prophylactic antibiotics for cesarean section
- VBAC instead of routine repeat cesarean section
- Prostaglandins for cervical ripening
- Antibiotics for PPRM
- Prophylactic antibiotics for GBS

## Non-evidence-based interventions

- Routine enema & shave prep
- Delivery in operating room
- Prophylactic forceps
- Routine episiotomy
- Routine neonatal suction
- Suction below cords (meconium)
- One-step delivery
- Early cord clamping

## Placental Transfusion (Farrar BJOG 2010)

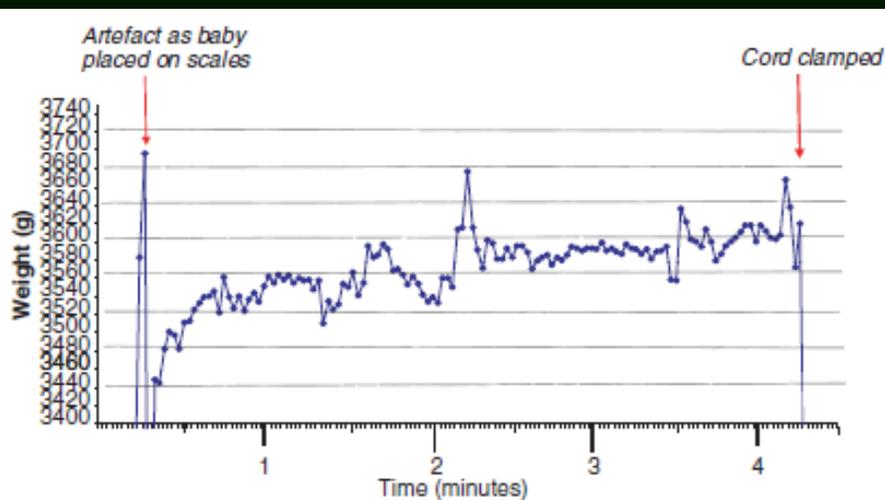


Figure 1. Weight change from birth to cord clamping.

## DCC Benefits – Very preterm Infants

**Table 3** Benefits of DCC for very preterm infants

---

**Very preterm infants <30 weeks**

---

Delaying cord clamping by 20–45 seconds

2–3-fold reduction in intraventricular hemorrhage

Reduced need for blood transfusions

Greater mean blood pressures in the first hours of life

No difference in Apgar scores at 5 minutes/body temperature

Just short of statistical significance for halving of mortality with DCC in these infants

---

Abbreviation: DCC, delayed cord clamping.