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

4th Northern Perinatal Conference
Smithers, B.C. Sept 17th, 2016

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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, 23rd 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 15th 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'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 ≥ 5 min = 23.5%


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

Shoulder Dystocia Definition


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.

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**HBI & Shoulder Dystocia**

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


- 0.011 per minute
## 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.


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

<table>
<thead>
<tr>
<th>Case</th>
<th>Parity</th>
<th>Gestation (weeks)</th>
<th>DM</th>
<th>Nonreassuring fetal heart rate pattern</th>
<th>Mode of delivery</th>
<th>HBDI (minutes)</th>
<th>Birth weight (kg)</th>
<th>Art. pH</th>
<th>Art. BE</th>
<th>Ven. pH</th>
<th>Ven. BE</th>
<th>ASS</th>
<th>HIE</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>39</td>
<td>No</td>
<td>No</td>
<td>Instrumental</td>
<td>5</td>
<td>4.285</td>
<td>7.151</td>
<td>-15.20</td>
<td>7.155</td>
<td>-14.40</td>
<td>5</td>
<td>1</td>
<td>Recovered</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>40</td>
<td>No</td>
<td>Yes</td>
<td>Instrumental</td>
<td>4</td>
<td>3.940</td>
<td>7.199</td>
<td>-9.20</td>
<td>7.233</td>
<td>-9.40</td>
<td>8</td>
<td>1</td>
<td>Recovered</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>41</td>
<td>No</td>
<td>No</td>
<td>Instrumental</td>
<td>5</td>
<td>3.560</td>
<td>7.195</td>
<td>-7.20</td>
<td>7.245</td>
<td>-8.20</td>
<td>2</td>
<td>1</td>
<td>Recovered</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>41</td>
<td>No</td>
<td>No</td>
<td>Instrumental</td>
<td>9</td>
<td>4.360</td>
<td>7.074</td>
<td>-6.60</td>
<td>7.268</td>
<td>-4.30</td>
<td>0</td>
<td>1</td>
<td>Recovered</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>39</td>
<td>No</td>
<td>No</td>
<td>Instrumental</td>
<td>14</td>
<td>3.635</td>
<td>7.182</td>
<td>-9.50</td>
<td>7.197</td>
<td>-10.30</td>
<td>0</td>
<td>2</td>
<td>Died 3 years</td>
</tr>
</tbody>
</table>
HBI & Shoulder Dystocia

• Among cases lasting ≥ 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 et al. 2011

- 0.0078 per minute
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!**

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**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
Acid-base physiology: case 1

- Healthy 25 y/o G2P1 @ 40 weeks gestation
- Spontaneous normal labour; normal IA
- Deep variable decelerations late 2nd 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
- pCO₂ = 90
- BD = 4
- Lactate = 4

**B:**
- pH = 6.99
- pCO₂ = 51
- BD = 12
- Lactate = 11
Acid-base physiology: case 2

- Healthy 32 y/o G₁ at 38 weeks gestation
- Frank breech presentation
- Normal spontaneous labour; good progress
- 45 minute 2ⁿᵈ 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

<table>
<thead>
<tr>
<th>Umbilical artery</th>
<th>Umbilical vein</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH = 6.99</td>
<td>pH = 7.32</td>
</tr>
<tr>
<td>pCO₂ = 90</td>
<td>pCO₂ = 44</td>
</tr>
<tr>
<td>BD = 4</td>
<td>BD = 3</td>
</tr>
<tr>
<td>Lactate = 4</td>
<td>Lactate = 3</td>
</tr>
</tbody>
</table>
## Acid-base physiology:
**Metabolic acidosis**

<table>
<thead>
<tr>
<th>Umbilical artery</th>
<th>Umbilical vein</th>
</tr>
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<tbody>
<tr>
<td>pH = 6.99</td>
<td>pH = 7.12</td>
</tr>
<tr>
<td>pCO$_2$ = 51</td>
<td>pCO$_2$ = 45</td>
</tr>
<tr>
<td>BD = 12</td>
<td>BD = 10</td>
</tr>
<tr>
<td>Lactate = 11</td>
<td>Lactate = 9</td>
</tr>
</tbody>
</table>

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

Intact Cord Resusc 3.0

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

<table>
<thead>
<tr>
<th>Term infants &gt;37 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delaying cord clamping for at least one minute</td>
</tr>
<tr>
<td>Higher early hemoglobin concentration</td>
</tr>
<tr>
<td>Increased iron reserves up to 6 months after birth</td>
</tr>
<tr>
<td>No difference in PPH rates</td>
</tr>
<tr>
<td>Higher birth weight</td>
</tr>
<tr>
<td>No statistically significant increase in jaundice or polycythemia</td>
</tr>
</tbody>
</table>

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

![Graph A: Cord clamp effect on caudal arterial pressure](image)

![Graph B: Cord clamp effect on heart rate](image)
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

<table>
<thead>
<tr>
<th>Respiratory acidosis</th>
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<tr>
<td>pH = 6.99</td>
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<td>BD = 12</td>
</tr>
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<td>Lactate = 4</td>
<td>Lactate = 11</td>
</tr>
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Acid-base physiology: Umbilical cord vein

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<th>Respiratory acidosis</th>
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<tr>
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<tr>
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<td>pCO₂ = 45</td>
</tr>
<tr>
<td>BD = 3</td>
<td>BD = 10</td>
</tr>
<tr>
<td>Lactate = 3</td>
<td>Lactate = 9</td>
</tr>
</tbody>
</table>

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

Autoroute-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
- Ecboics for post-partum hemorrhage
- Prophylactic antibiotics for cesarean section
- VBAC instead of routine repeat cesarean section
- Prostaglandins for cervical ripening
- Antibiotics for PPROM
- 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.
### Table 3 Benefits of DCC for very preterm infants

<table>
<thead>
<tr>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very preterm infants &lt;30 weeks</td>
</tr>
<tr>
<td>Delaying cord clamping by 20–45 seconds</td>
</tr>
<tr>
<td>2–3-fold reduction in intraventricular hemorrhage</td>
</tr>
<tr>
<td>Reduced need for blood transfusions</td>
</tr>
<tr>
<td>Greater mean blood pressures in the first hours of life</td>
</tr>
<tr>
<td>No difference in Apgar scores at 5 minutes/body temperature</td>
</tr>
<tr>
<td>Just short of statistical significance for halving of mortality with DCC in these infants</td>
</tr>
</tbody>
</table>

Abbreviation: DCC, delayed cord clamping.