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

SRPC ESS/OSS Conference

Banff AB, Jan 16th, 2020

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Learning Objectives

After this session, participants will be able to:

- Describe ‘one-step’ vs. ‘two-step’ delivery
- Discuss the role of head to body interval in neonatal outcome
- Explain the relationship between cord gases and fetal hypoxic ischemic encephalopathy in shoulder dystocia
- Revise the definition of shoulder dystocia
- Discuss implications for the management of shoulder dystocia

Presenter Disclosures

- In the past two years I have received teaching stipends from U of T, U.B.C., Karolinska University, and the Vancouver Island Health Authority.
- I have no commercial relationships to disclose.
- I will not be discussing of-label use of any medication (without regulatory approval).
- I received no financial or in-kind support to develop this presentation.
- I have not received payment or in-kind support from a commercial organization to present at this event.

Definitions

- HBI = Head to body interval
- HIE = Hypoxic ischemic encephalopathy
- SD = Shoulder dystocia

"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.

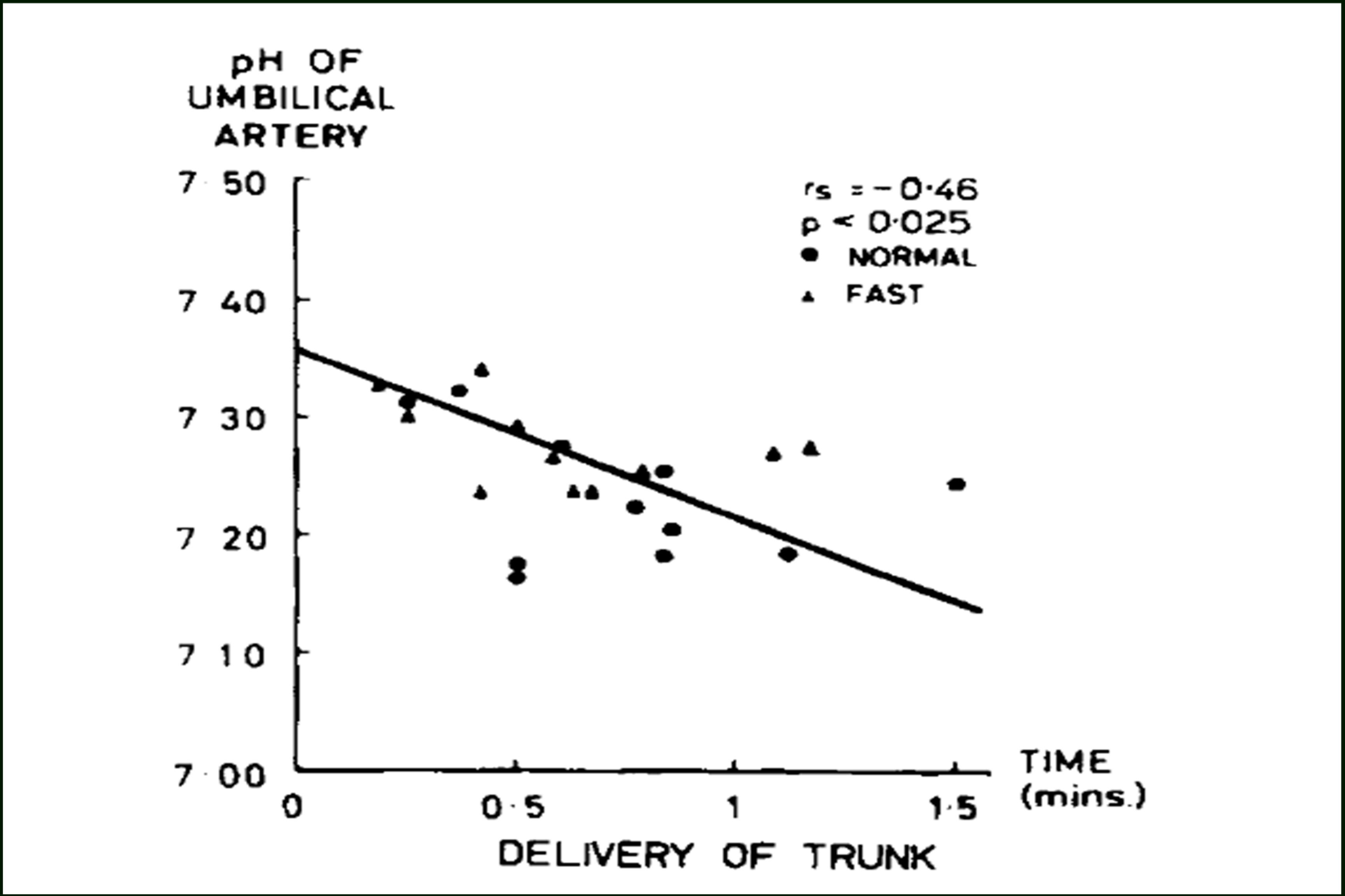
Which way?

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 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, HIE, & 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

Incidence in series varies from ¼% to 6%.

Why?

Shoulder Dystocia Definition

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

(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)

‘Worry & Hurry’

- If head doesn’t deliver right away, it could be SD.
- If head takes longer than 60s, it is SD.
- In SD, increased HBI = poorer outcome.

Therefore:

→ increased HBI is dangerous in every birth,

→ Better to always deliver the body immediately after the head.

Two-step delivery (Locatelli et al. 2011)

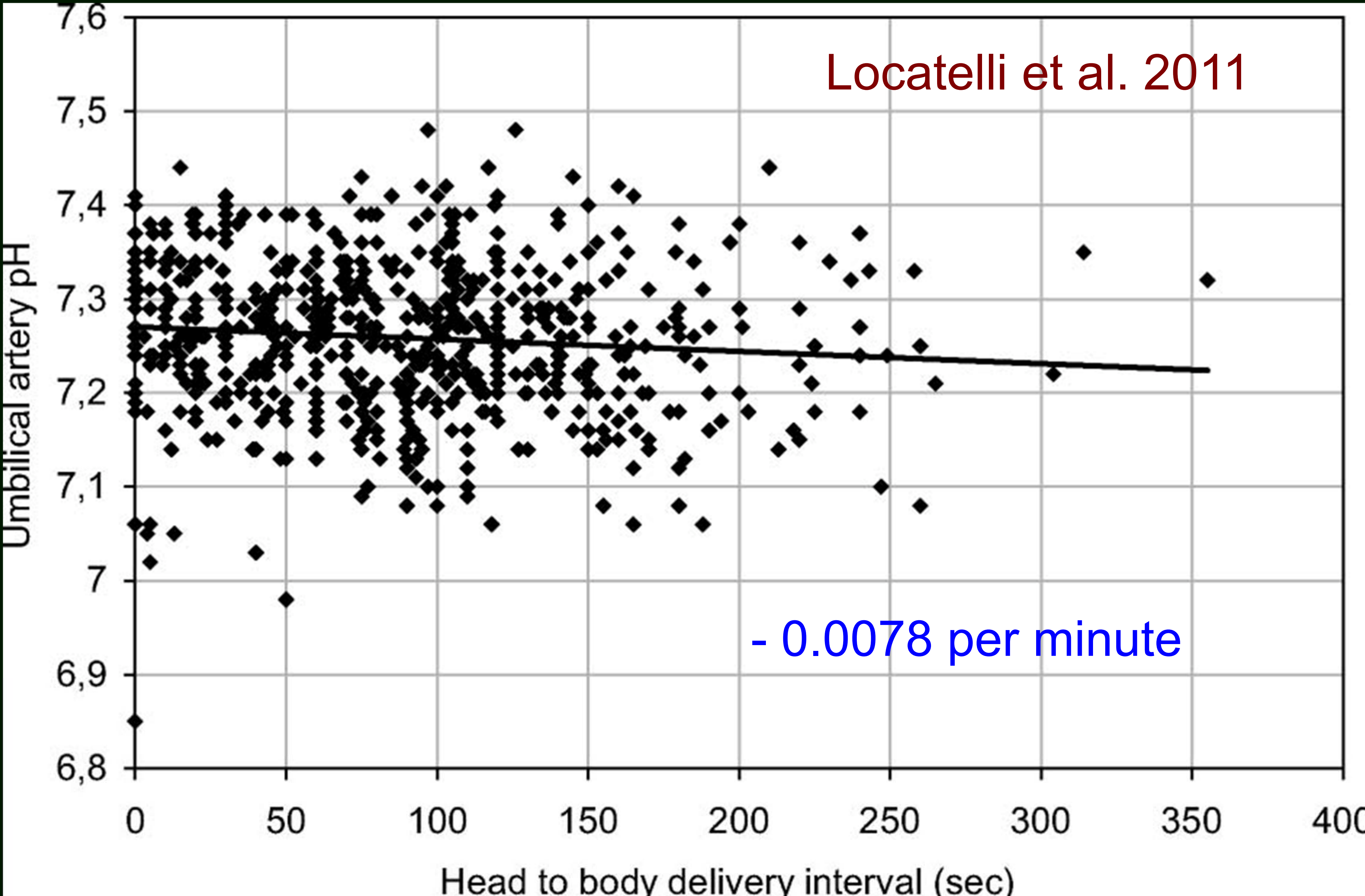
- Prospective study of HBI in 1231 vaginal births
- Followed maternal urge to push in position of choice
- Awaited restitution without manipulation following delivery of the head
- Waited for next uterine contractions to accomplish spontaneous delivery of the shoulders & body
- Turtle sign observed in 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 fetal head and body in 1 contraction
- In 15 women, HBI was > 4 minutes (max = 6 min)
- 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))


Locatelli et al. 2011
- 0.0078 per minute
Umbilical artery pH
Head to body delivery interval (sec)
7,6
7,5
7,4
7,3
7,2
7,1
7
6,9
6,8
0
50
100
150
200
250
300
350
400

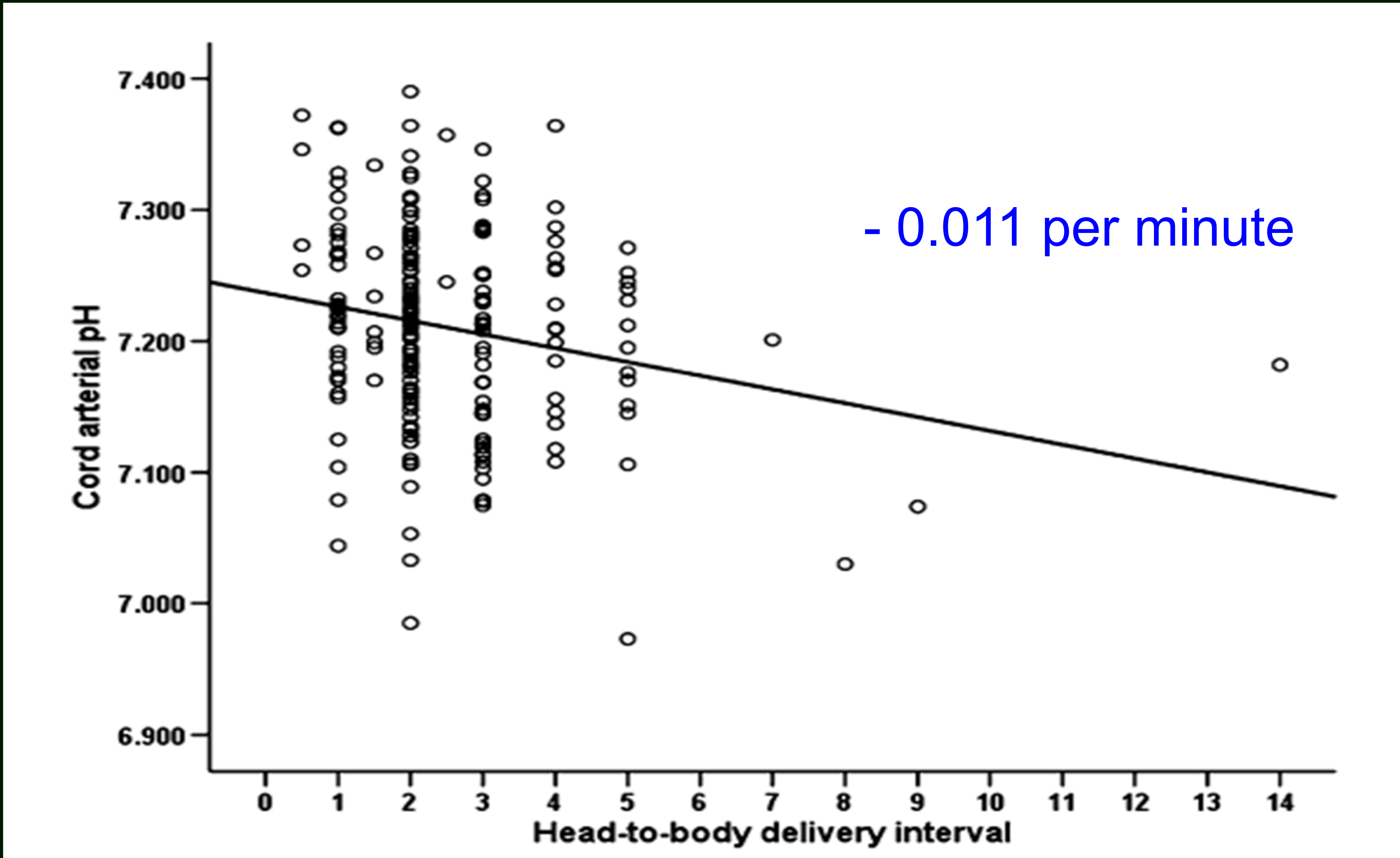
Normal Birth ≠ Shoulder Dystocia

- In normal birth,
  - Head to body interval is usually longer than 60s;
  - Cord pH is not altered by the head to body interval;
  - Allowing mother to follow her instincts results in lowest reported incidence of SD in the literature.

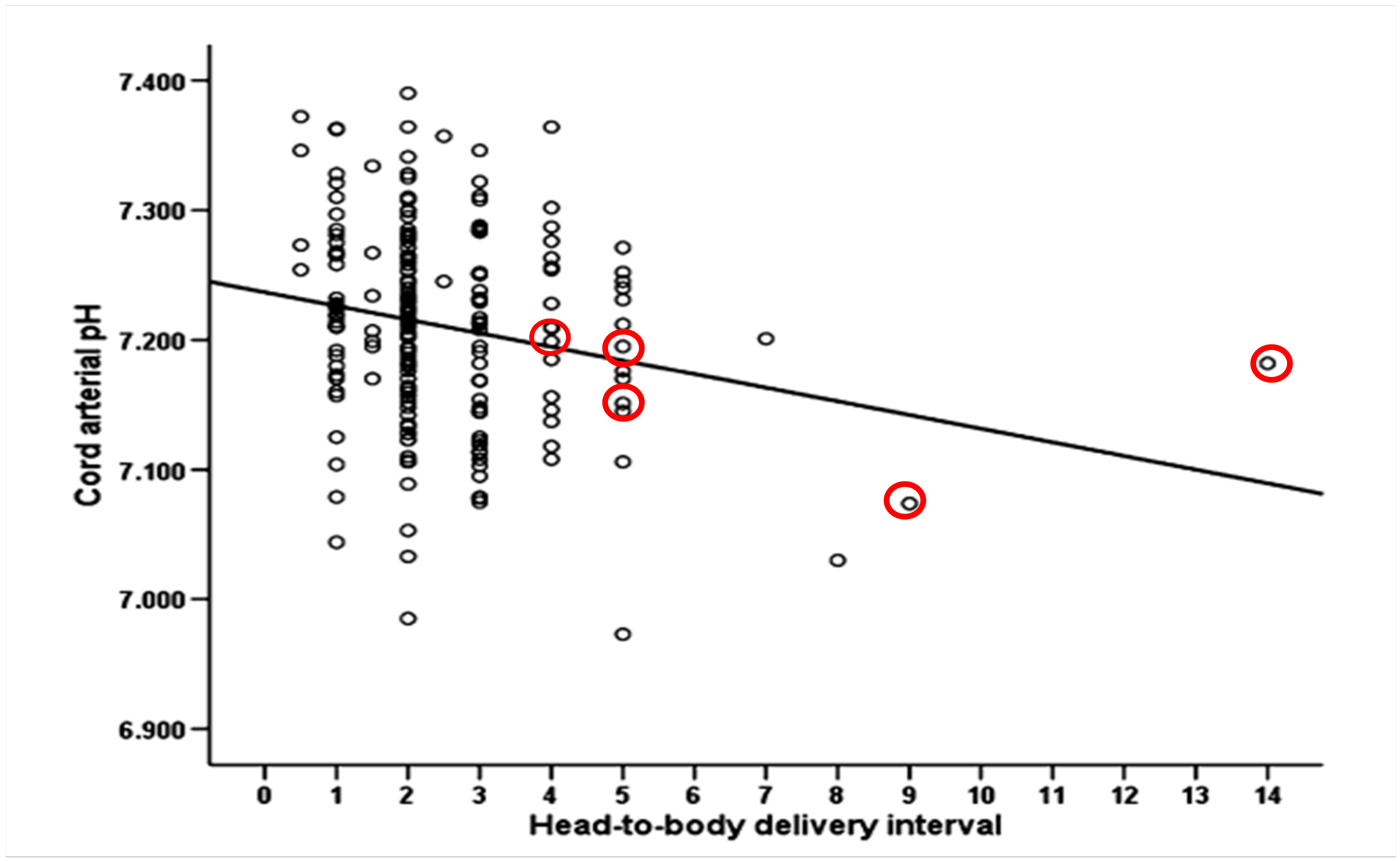
HBI, HIE, & Shoulder Dystocia

- 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	−3.60	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 Obstet Gynecol 2001;185:268-74)

Perinatal Asphyxia =

- Arterial cord pH < 7.0
- Arterial cord base deficit > 12
- 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?

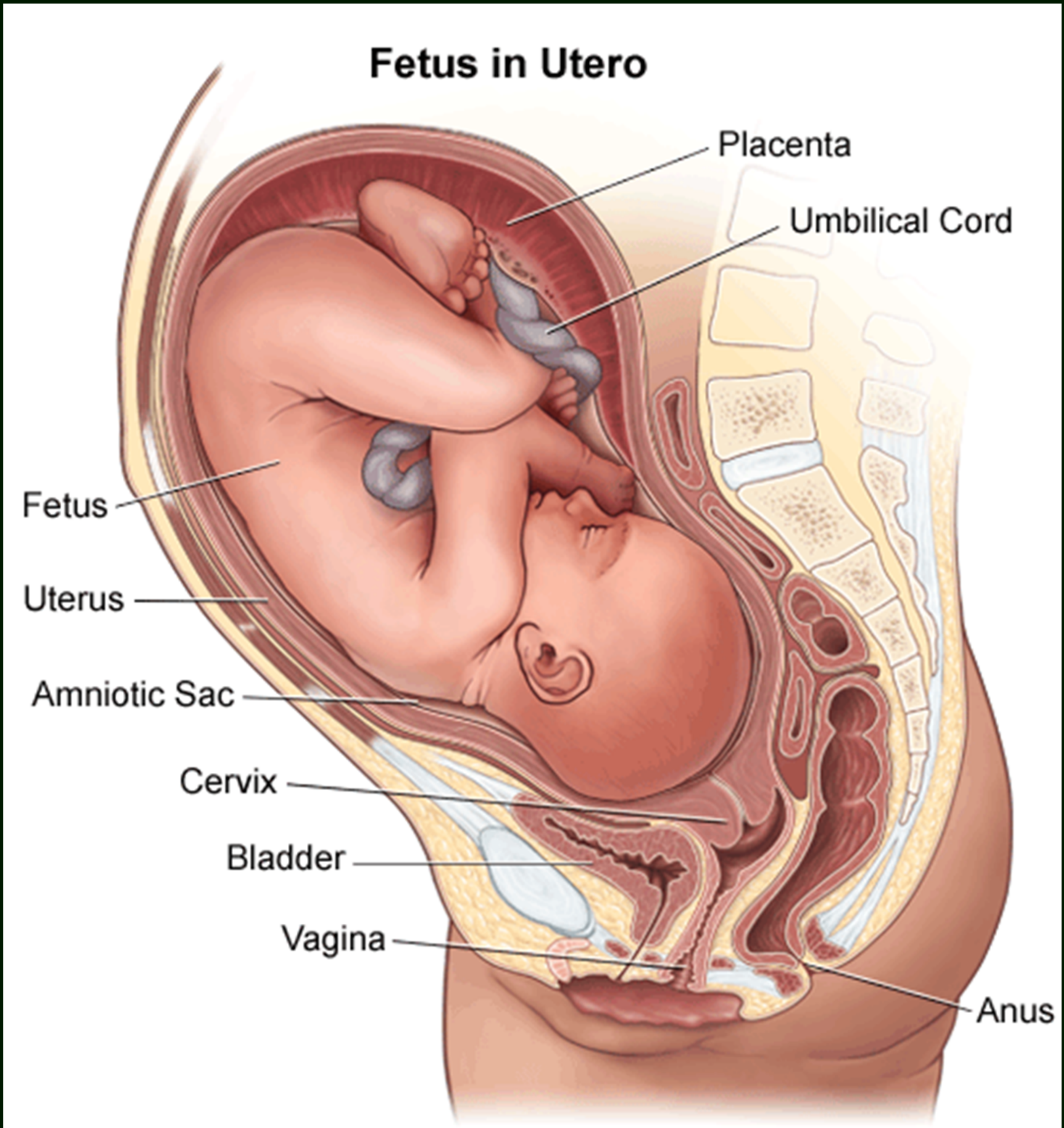
Intrauterine Pressure

Between Contr. =
10-20 mm Hg

During Contr. =
50-70 mm Hg

Contr. + Valsalva =
120 mm Hg

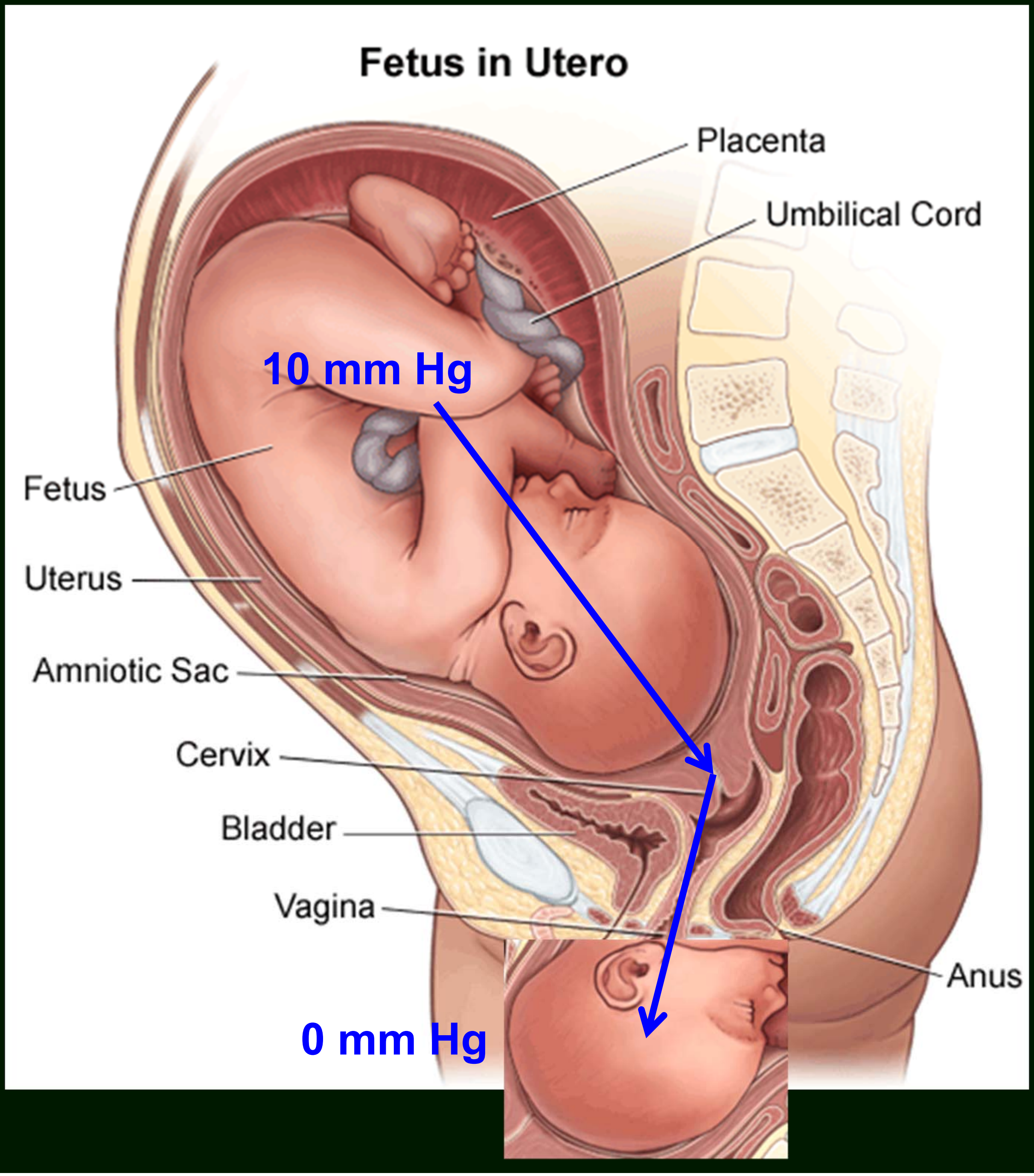
Outside pressure =
0 mm Hg



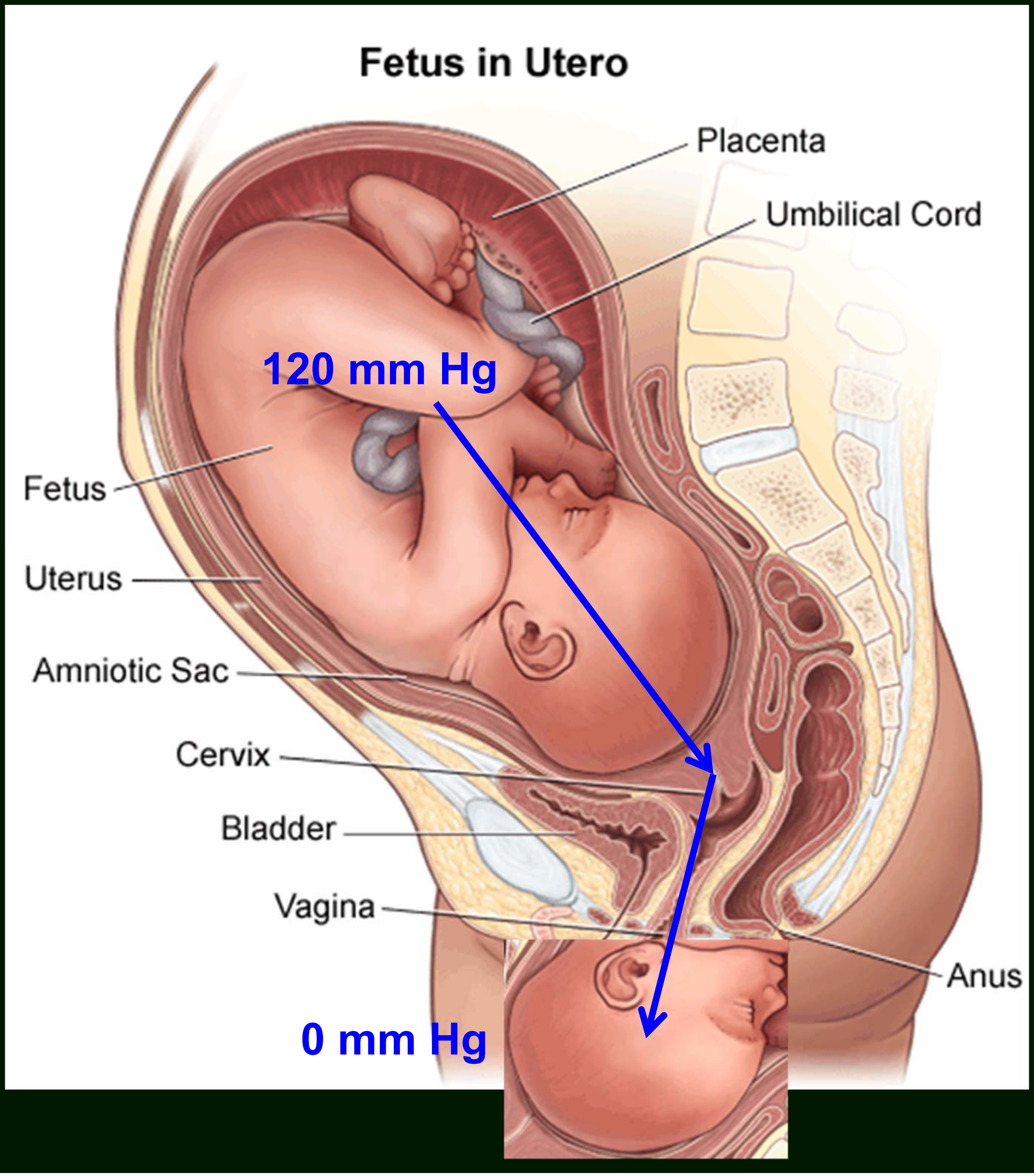
Intrauterine Pressure

Between Contr. =
10-20 mm Hg

Outside pressure =
0 mm Hg



Intrauterine Pressure



Contr. + Valsalva =
120 mm Hg

Outside pressure =
0 mm Hg

Summary

- Allowing a physiological pause between delivery of head and body is not harmful because intrauterine pressure is low (*caveat);
- Including HBI > 60 in a definition of SD will increase the incidence of ‘imaginary’ SD;
- Two-step delivery may prevent ‘real’ SD;
- If delivery not accomplished spontaneously with next contraction, SD is present.

*Caveat

An abnormal FHR is evidence of fetal compromise

→ fetal status is deteriorating!

One-step delivery is indicated!

Implications for SD Management

- Don’t PANIC or PULL

Why?

Implications for SD Management

- Don’t PANIC or PULL
- Mother should NOT PUSH between contractions →
- Relaxed uterus between contractions:
  - maximizes fetal cerebral perfusion and
  - enhances the effectiveness of SD maneuvers

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

Intact Cord Resuscitation: Much more than hemoglobin

SRPC ESS/OSS Conference

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Yellowknife, NT, Canada

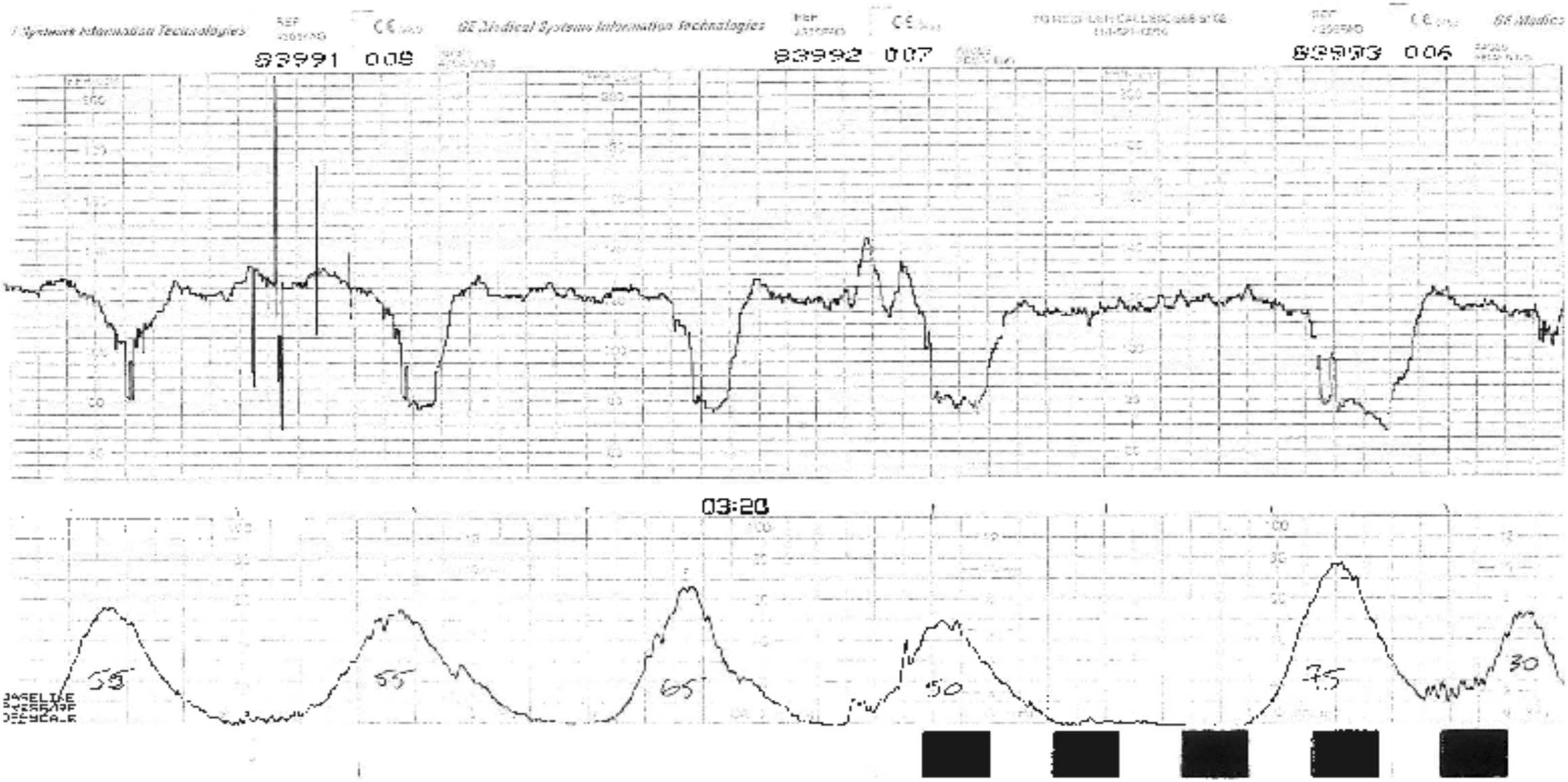
Learning Objectives

After this session, participants will be able to:

- Describe the physiology of fetal respiratory and metabolic acidosis
- Discuss the physiology and benefit of placental auto-transfusion post delivery
- List the benefits of delayed cord clamping for term and preterm infants
- Describe practical options to achieve intact cord resuscitation

Acid-base physiology: case

- Healthy 25 y/o G_2P_1 @ 40 weeks gest^n
- Spontaneous normal labour; normal IA
- Deep variable decelerations late 2nd stage, with good recovery
- Terminal bradycardia x 7 minutes
- Tight nuchal cord – delivered through loop
- Flat baby
- Cord gases?


GE Medical Systems Information Technologies
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Umbilical cord artery

A:

- pH = 6.99
- pCO_2 = 90
- Lactate = 4

B:

- pH = 6.99
- pCO_2 = 51
- Lactate = 11

Umbilical cord artery

A:

- pH = 6.99
- pCO_2 = 90
- Lactate = 4

B:

- pH = 6.99
- pCO_2 = 51
- Lactate = 12

Acid-base physiology:
Respiratory acidosis

Umbilical artery

- pH = 6.99
- pCO_2 = 90
- Lactate = 4

Umbilical vein

- pH =
- pCO_2 =
- BD =

Acid-base physiology:
Respiratory acidosis

Umbilical artery

- pH = 6.99
- pCO_2 = 90
- Lactate = 4

Umbilical vein

- pH = 7.32
- pCO_2 = 44
- Lactate = 2.5

Acid-base physiology case: my management

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

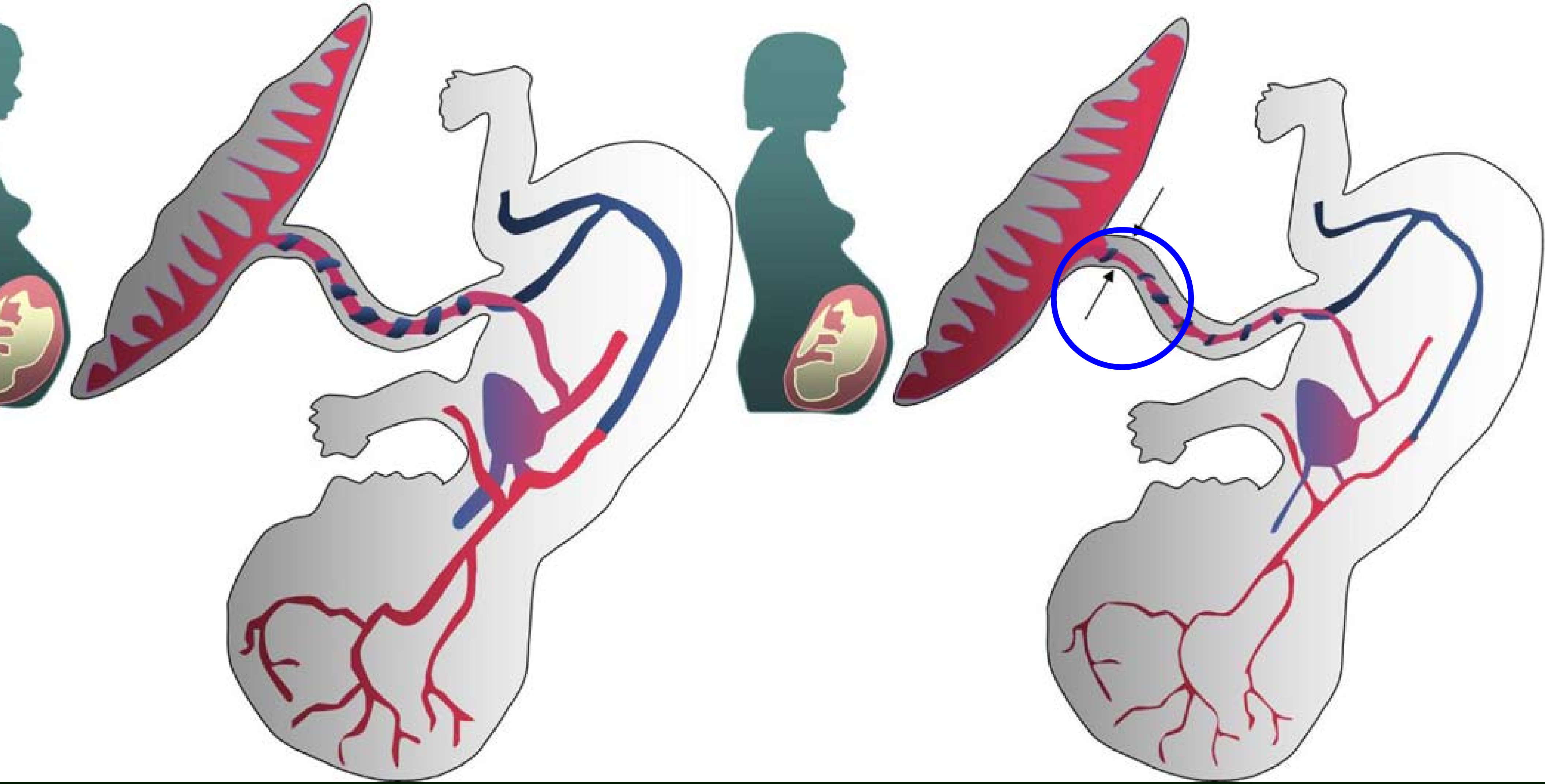
Acid-base physiology: case

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

Acid-base physiology: case

- Delivery of flat baby;
- Cord clamped immediately;
- Baby to Paediatrician & resuscitation bay;
- Successful resuscitation with PPV;
- Slow transition: poor tone, lethargic, pale

Why?



Uwins & Hutcheon. Pediatric Health, Medicine and Therapeutics 2014

"Serial blood volume measurements were made in 27 normal full-term newborn infants using iodinated human albumin. At the moment of birth the newborn infant was estimated to have a blood volume of 78 ml/kg with a venous hematocrit of 48 %. When the cord-clamping was delayed for 5 minutes the blood volume increased by 61 % to 126 ml/kg. This placental transfusion amounted to 166 ml for a 3500 g infant, one-quarter of which occurred in the first 15 seconds, and one-half within 60 seconds of birth."

Usher et al. Acta Paediatrica 1963;52(5):497-512

Auto-transfusion = serious volume & oxygen carrying capacity

- Delaying cord clamping 1 minute allows ~ 90 cc auto-transfusion from placenta to fetus, or 20 - 25 ml per kg birth weight.
- The proportionate equivalent in an adult would be 1 L of whole blood
- Further delay of 2-4 minutes results in another ~ 70 cc transfusion
- Total transfusion equivalent in an adult = <u>1800 cc</u>

Placental Transfusion (Farrar BJOG 2010)

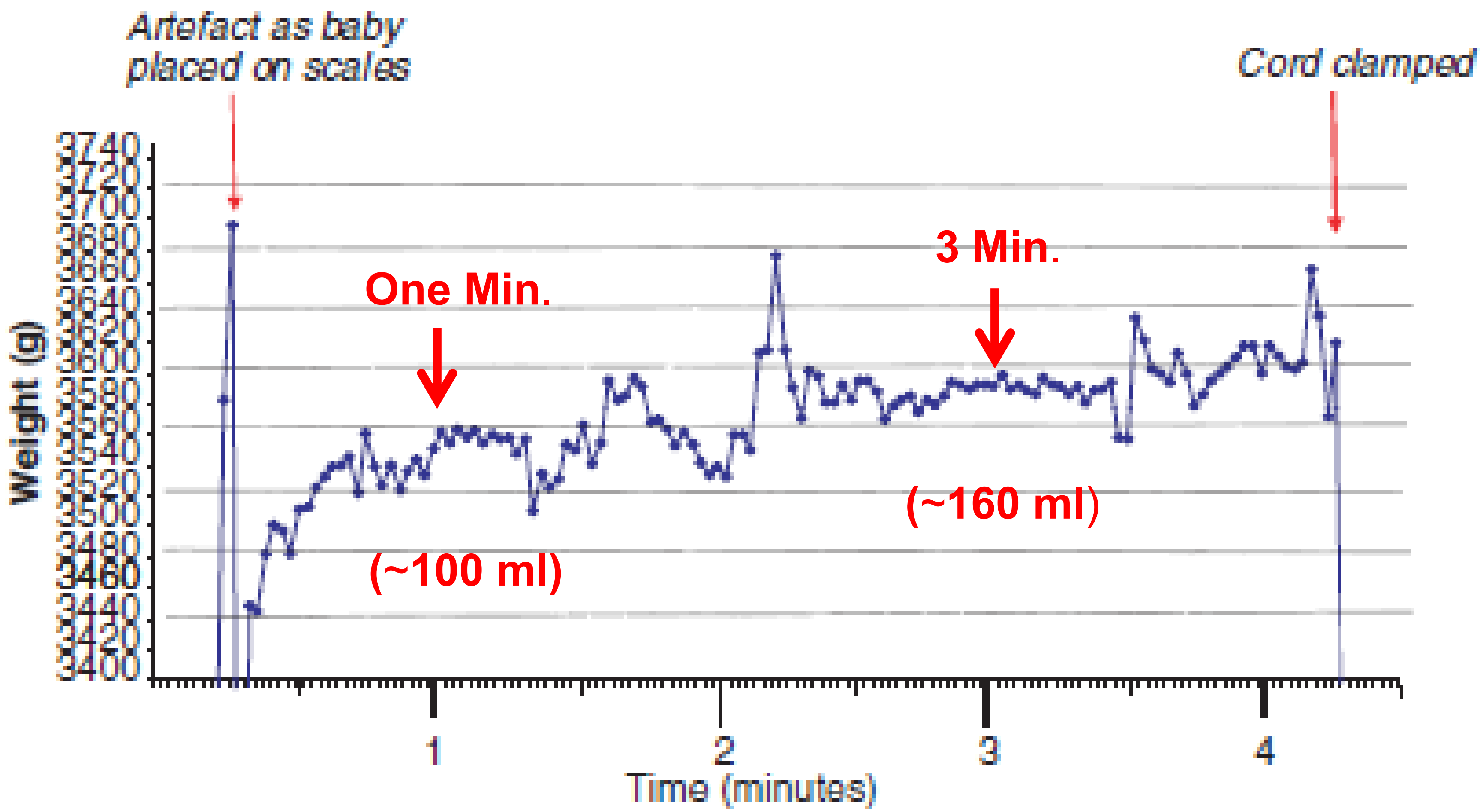
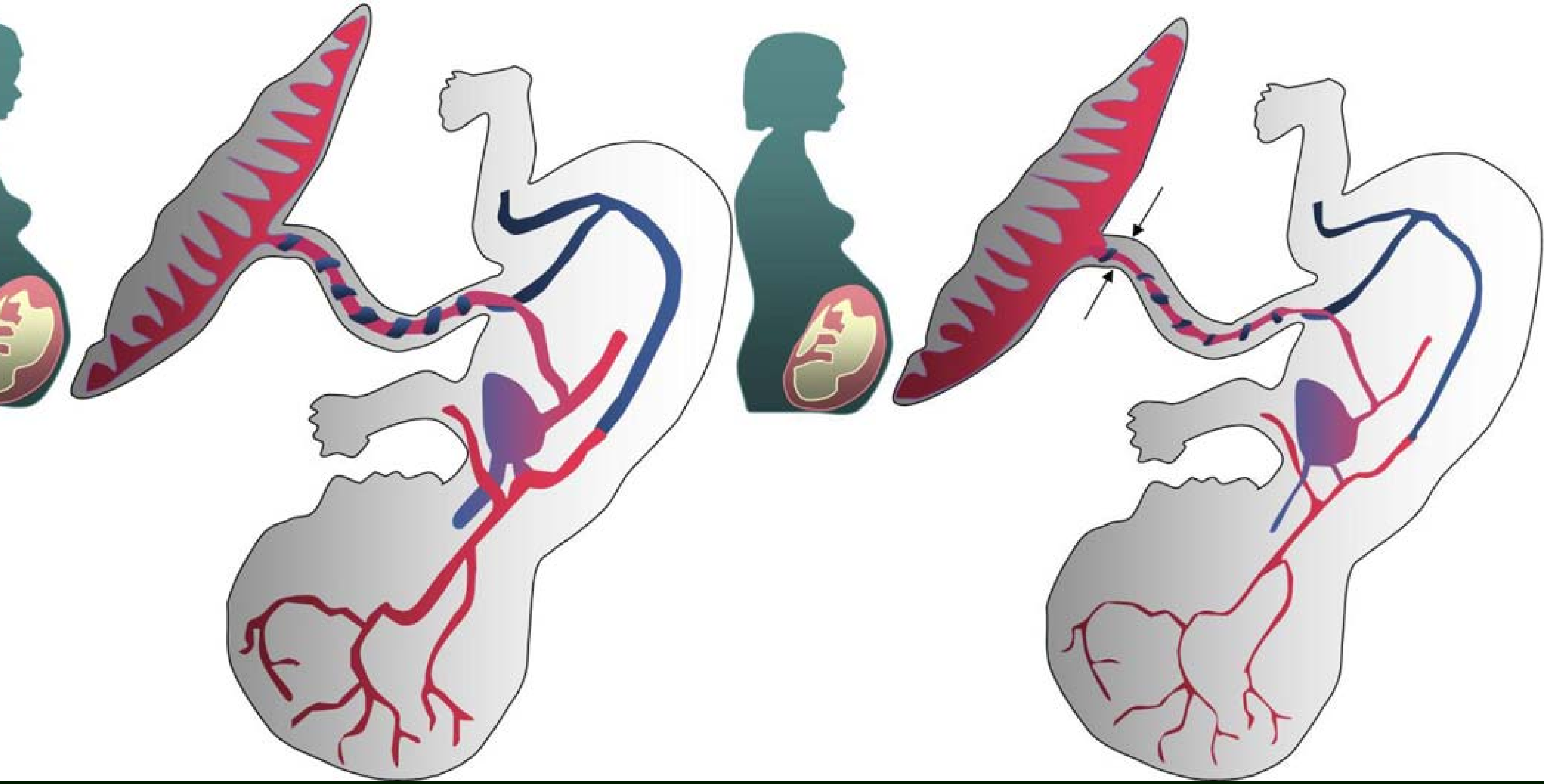
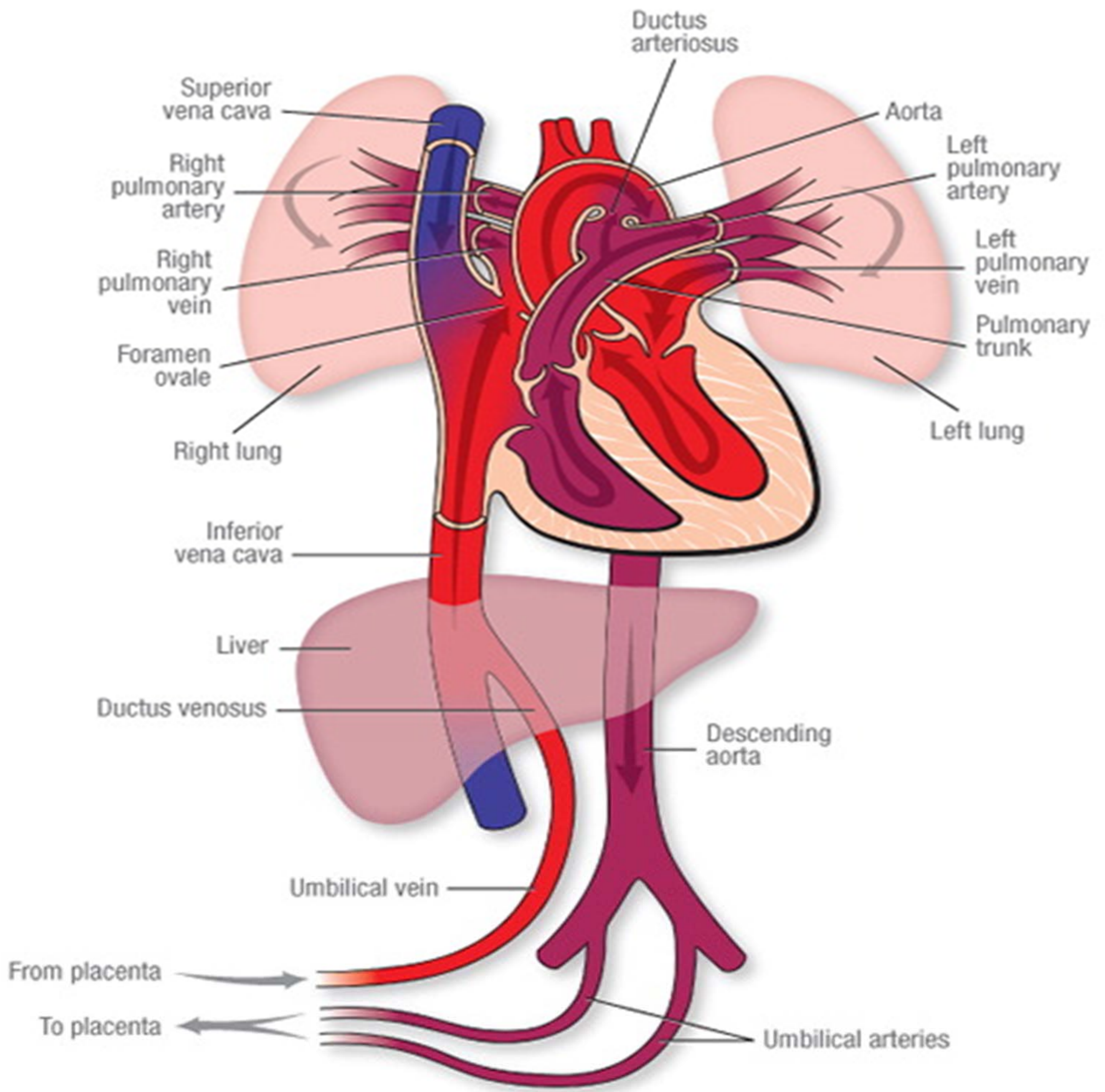


Figure 1. Weight change from birth to cord clamping.



Uwins & Hutcheon Pediatric Health, Medicine and Therapeutics 2014

Fetal Circulation



Ductus arteriosus
Superior vena cava
Aorta
Left pulmonary artery
Right pulmonary artery
Left pulmonary vein
Right pulmonary vein
Pulmonary trunk
Foramen ovale
Right lung
Left lung
Inferior vena cava
Liver
Ductus venosus
Descending aorta
Umbilical vein
From placenta
To placenta
Umbilical arteries

Auto-resuscitation

- If fetal metabolic acidosis is absent, residual placental blood has:
  - High oxygen content,
  - Low CO_2,
  - Normal pH.

→Auto-transfusion improves brain and cardiac perfusion & function within 45 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?

- Delays resuscitation measures - unless logistical modifications to allow NRP with cord intact for 1-2 minutes

Intact Cord Resusc. 1.0

Intact Cord Resusc. 2.0

Intact Cord
Resusc. 3.0

Intact Cord Resusc. 4.0

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

Intact Cord Resusc. 5.0

LifeStart Neonatal Resuscitation Unit

DCC Benefits – Term Infants

Uwins & Hutcheon Pediatric Health, Medicine and Therapeutics 2014

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

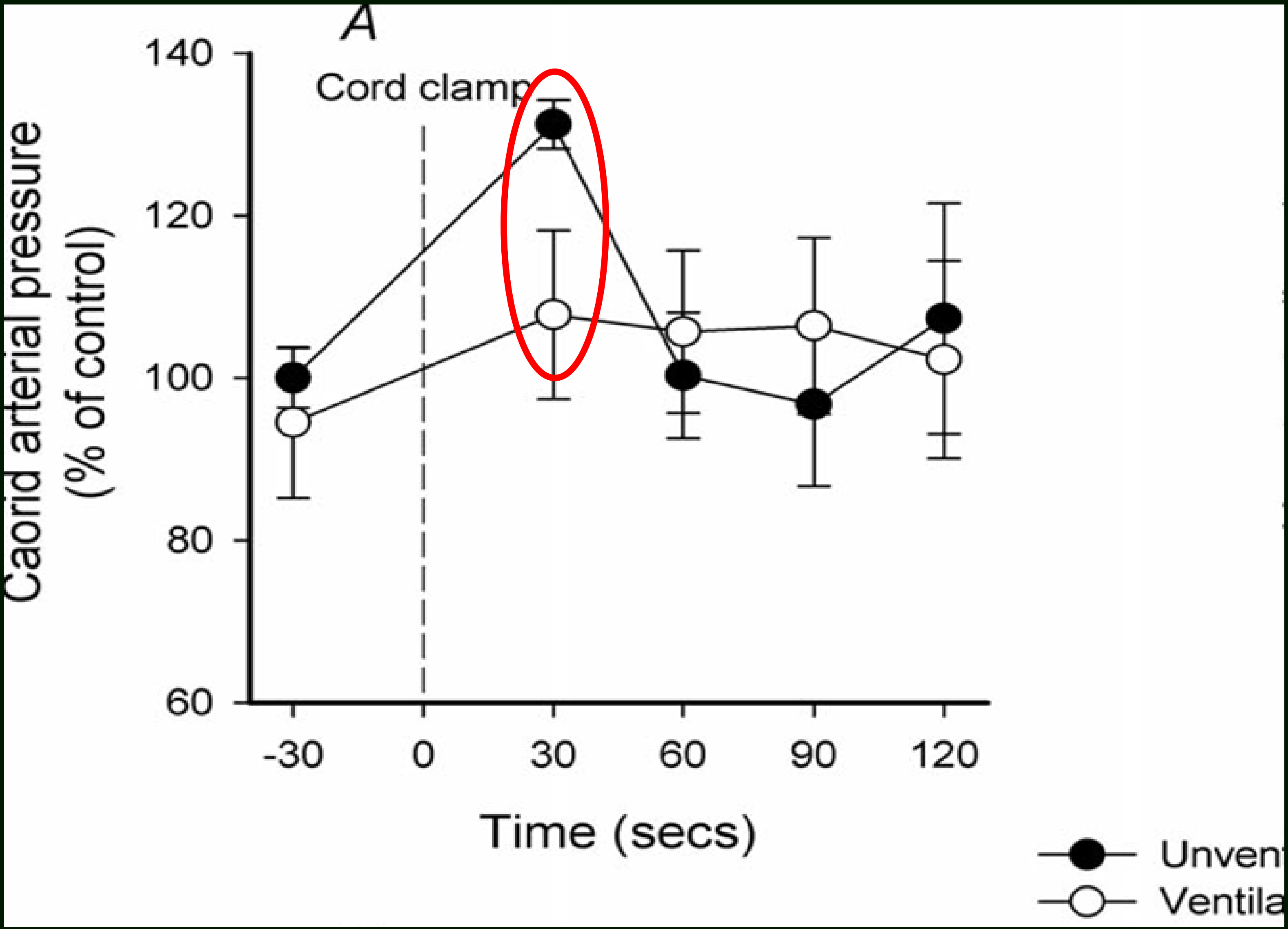
Uwins & Hutcheon Pediatric Health, Medicine and Therapeutics 2014

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

(Bhatt et. Al. J Physiol 2013)



DCC Benefits – Preterm Infants

Randomised trial of cord clamping and initial stabilisation at very preterm birth

Lelia Duley,[1] Jon Dorling,[2] Angela Pushpa-Rajah,[3] Sam J Oddie,[4] Charles William Yoxall,[5] Bernard Schoonakker,[6] Lucy Bradshaw,[1] Eleanor J Mitchell,[1] Joe Anthony Fawke,[7] on behalf of the Cord Pilot Trial Collaborative Group

Duley L, *et al*. *Arch Dis Child Fetal Neonatal Ed* 2017;**0**:F1–F9. doi:10.1136/archdischild-2016-312567

BMJ

OPEN ACCESS

DCC Benefits – Preterm Infants

- 135 infants cord clamped ≥2 min
- 135 infants cord clamped ≤ 20 sec
- Median gestation 28.9 and 29.2 weeks.
- Median time to clamping 120s and 11s.
- NN death:
  - 7/135 infants with intact cord care (5.2%)
  - 15/135 infants clamped cord care (11.1%)
  - risk difference (RD) −5.9%; NNT = 17

FIGURE 3

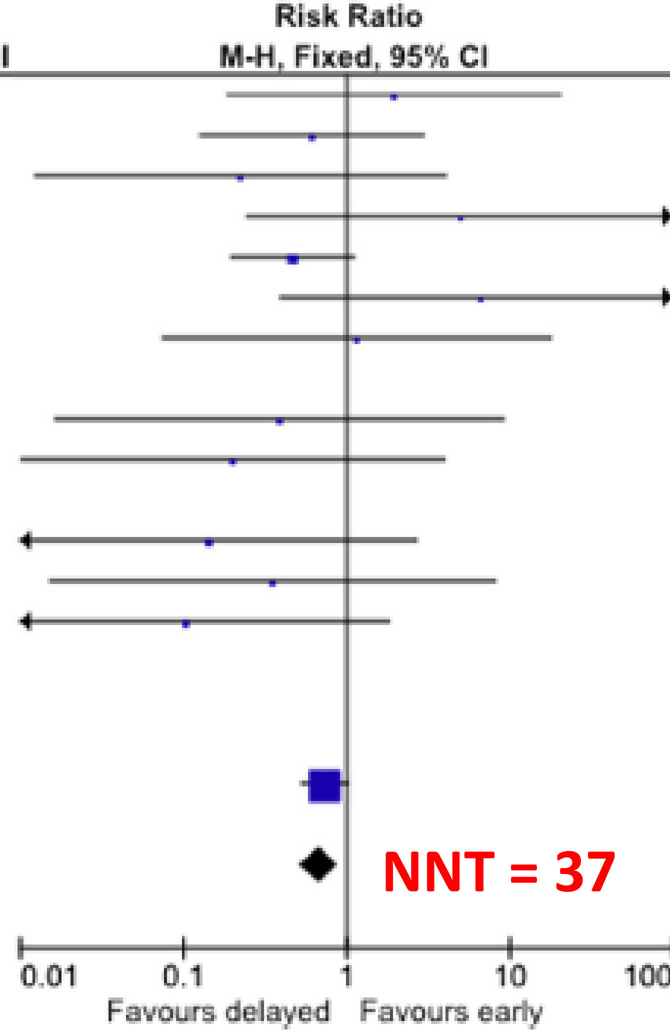
Meta-analyses showing effect of delayed clamping on mortality

Study or Subgroup	Delayed Events	Delayed Total	Early Events	Early Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Armanian 2017	2	32	1	31	0.9%	1.94 [0.18, 20.30]
Backes 2016	2	18	4	22	3.1%	0.61 [0.13, 2.96]
Baenziger 2007	0	15	3	24	2.3%	0.22 [0.01, 4.04]
Datta 2017	2	60	0	60	0.4%	5.00 [0.25, 102.00]
Duley 2016	7	135	15	135	12.8%	0.47 [0.20, 1.11]
Hofmeyr 1988	5	24	0	14	0.5%	6.60 [0.39, 111.10]
Hofmeyr 1993	1	40	1	46	0.8%	1.15 [0.07, 17.80]
Kinmond 1992	0	17	0	19		Not estimable
Kugelman 2007	0	30	1	35	1.2%	0.39 [0.02, 9.16]
McDonnell 1997	0	23	2	23	2.1%	0.20 [0.01, 3.95]
Mercer 2003	0	16	0	16		Not estimable
Mercer 2006	0	36	3	36	3.0%	0.14 [0.01, 2.67]
Rabe 2000	0	19	1	20	1.2%	0.35 [0.02, 8.10]
Ranjit 2015	0	44	5	50	4.4%	0.10 [0.01, 1.81]
Strauss 2003	0	45	0	60		Not estimable
Tanprasertkul 2016	0	42	0	44		Not estimable
Ultee 2008	0	18	0	19		Not estimable
WTM APTS 2017	58	784	79	782	67.3%	0.73 [0.53, 1.01]
Total (95% CI)		**1398**		**1436**	**100.0%**	**0.68 [0.52, 0.90]**
Total events	77		115			

Heterogeneity: $Chi^2 = 10.28$, $df = 12$ ($P = 0.59$); $I^2 = 0\%$

Test for overall effect: $Z = 2.75$ ($P = 0.006$)

ARR = 2.7%



Meta-analyses showing effect of delayed vs early cord clamping on risk ratio for hospital mortality in 18 trials in 2834 infants <37 weeks' gestation (top) and 3 trials in 996 infants ≤28 weeks' gestation (bottom).

APTS, Australian Placental Transfusion Study; *CI*, confidence interval; *M-H*, Mantel-Haenszel.

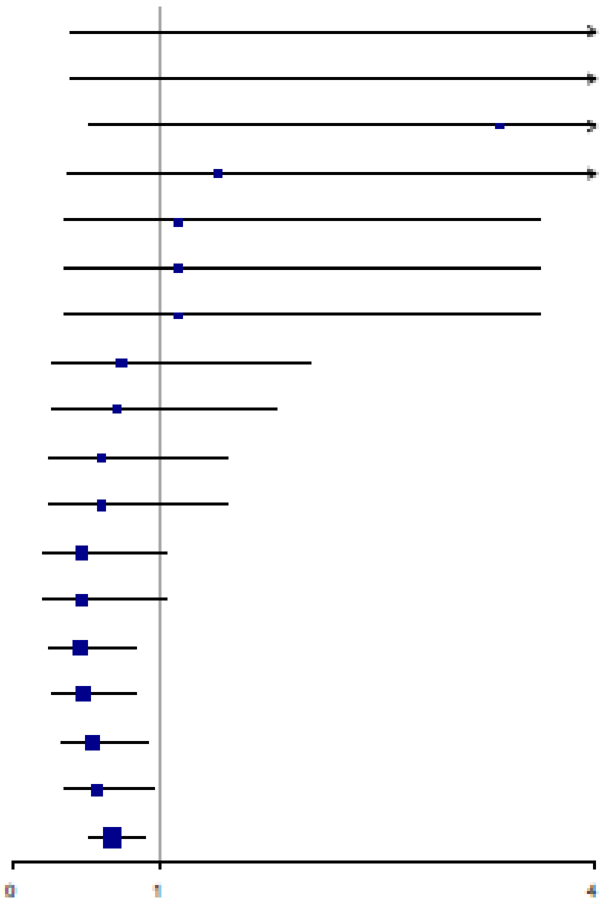
Fogarty et al. Delayed vs early cord clamping for preterm. Am J Obstet Gynecol 2018.

Fogarty et al AJOG 2018

FIGURE 5

Cumulative meta-analysis of effect of delayed clamping on hospital mortality

Study	Risk Ratio	95% Confidence Interval	P Value
Hofmeyr 1988	6.60	0.39-111.11	0.19
Kinmond 1992	6.60	0.39-111.11	0.19
Hofmeyr 1993	3.34	0.52-21.51	0.20
McDonnell 1997	1.40	0.38-5.16	0.61
Rabe 2000	1.13	0.35-3.61	0.84
Mercer 2003	1.13	0.35-3.61	0.84
Strauss 2003	1.13	0.35-3.61	0.84
Mercer 2006	0.74	0.27-2.04	0.56
Kugelman 2007	0.70	0.27-1.81	0.46
Baenziger 2007	0.60	0.24-1.47	0.26
Ultee 2008	0.60	0.24-1.47	0.26
Ranjit 2015	0.46	0.20-1.05	0.07
Tanprasertkul 2016	0.46	0.20-1.05	0.07
Duley 2016	0.46	0.25-0.84	0.01
Backes 2016	0.48	0.27-0.84	0.01
Datta 2017	0.54	0.32-0.92	0.02
Armanian 2017	0.57	0.34-0.96	0.04
APTS 2017	0.68	0.52-0.90	0.006



Cumulative meta-analysis of effect of delayed vs early cord clamping on risk ratio (RR) of primary outcome of hospital mortality, in 18 trials arranged in order of publication.

APTS, Australian Placental Transfusion Study; *CI*, confidence interval; *RR*, Risk ratio (i.e. relative risk).

Fogarty et al. Delayed vs early cord clamping for preterm. Am J Obstet Gynecol 2018.

Fogarty et. Al.
AJOG 2018

"Clamping the functioning umbilical cord at birth is an unproved intervention"

David J R Hutchon

"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)


A Kotaska