The first Golden Minute

Delivery room handling of newborn infants

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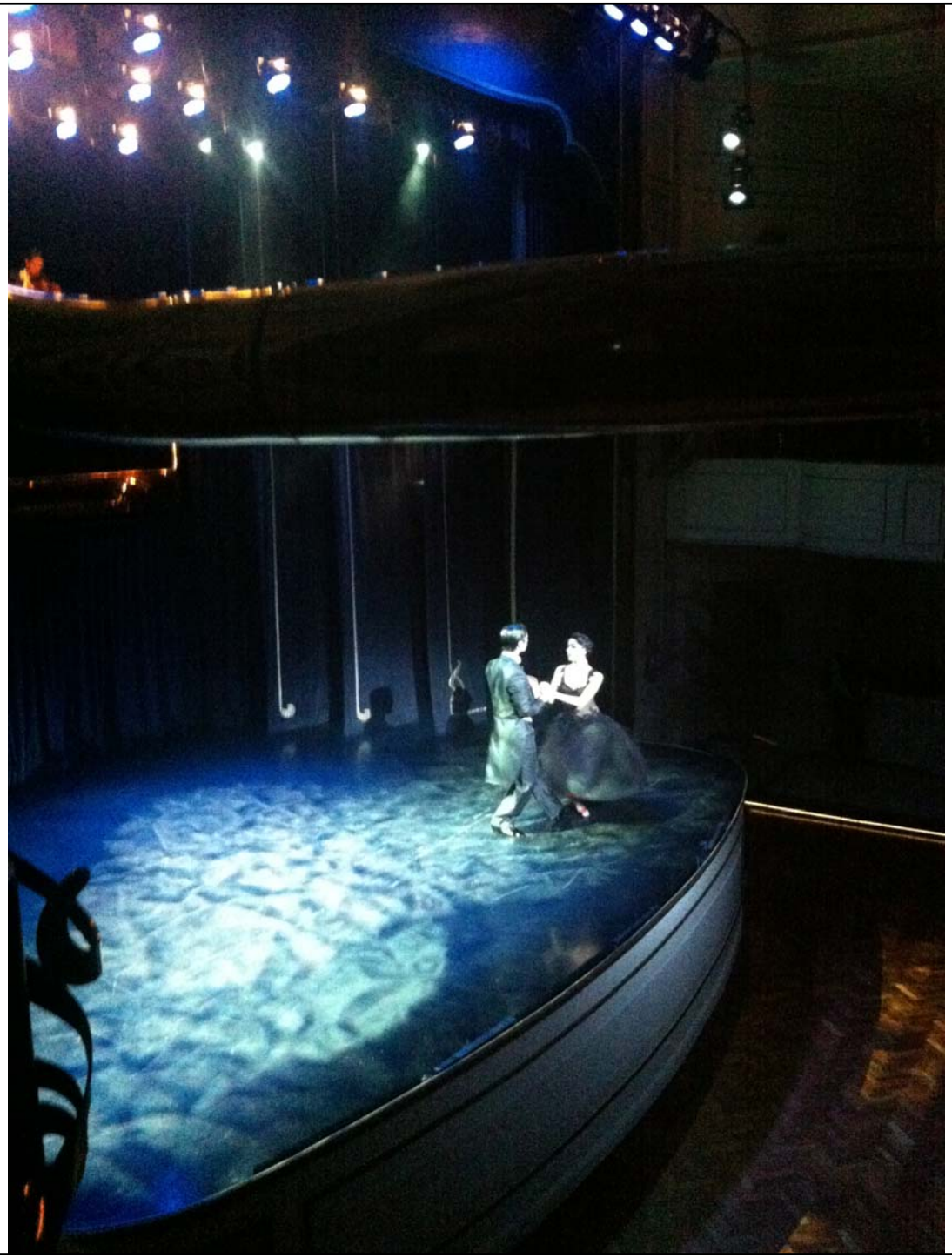
2º Congreso Argentino de Neonatologia, Buenos Aires, June 27-29, 20013

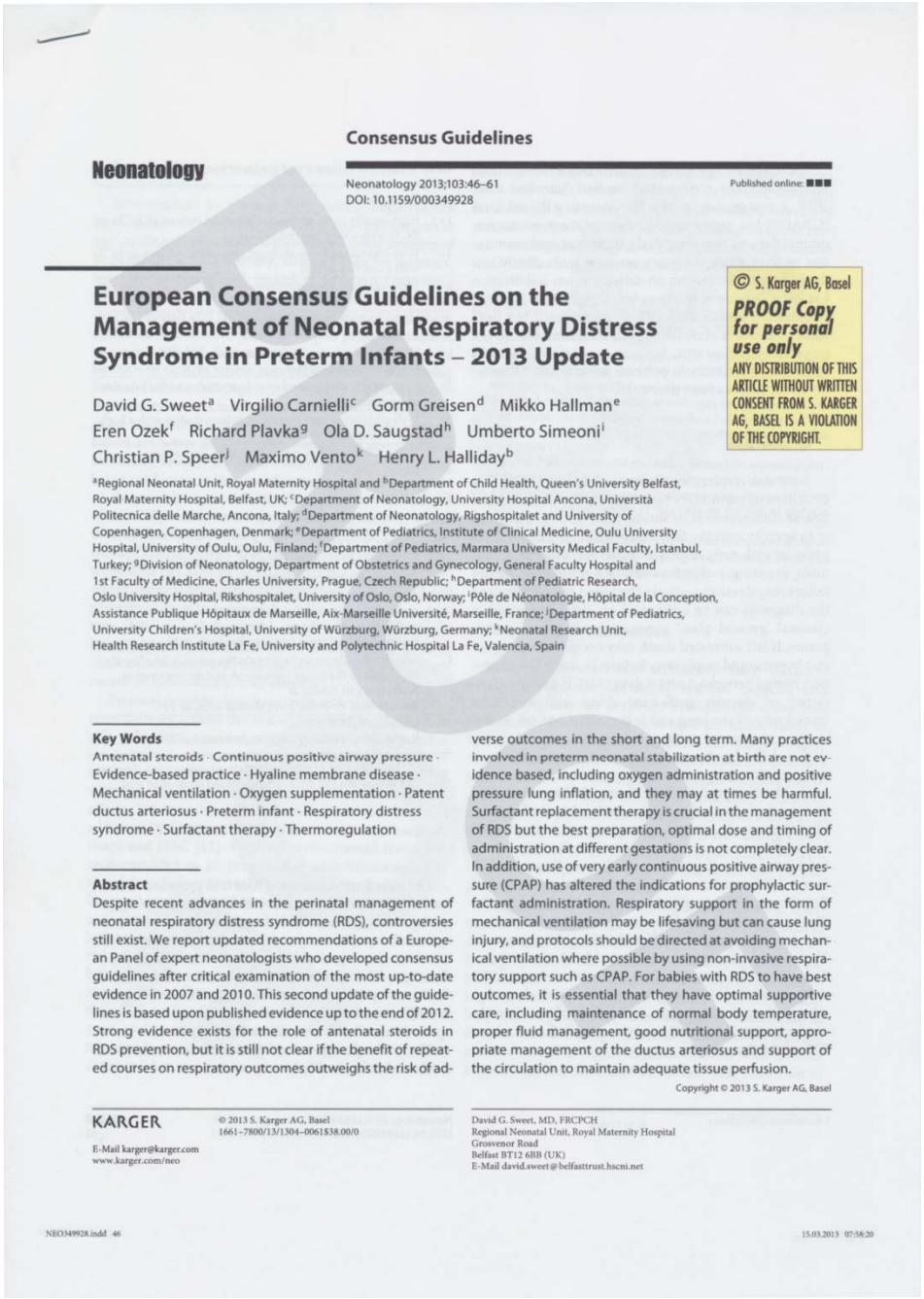


Delivery Room Stabilisation

Delivery room management

- Adequate preparation
- Cord clamping
- Free airways
- Maintenance of neutral thermal environment
- Appropriate use of supplemental oxygen
- Non invasive respiratory support
- Timely administration of surfactant
- Teamwork and communication

New European Guidelines
On Management of RDS



Consensus Guidelines

Neonatology

Neonatology 2013;103:46–61
DOI: 10.1159/000349928

Published online: ■■■

European Consensus Guidelines on the Management of Neonatal Respiratory Distress Syndrome in Preterm Infants – 2013 Update

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Key Words
Antenatal steroids · Continuous positive airway pressure · Evidence-based practice · Hyaline membrane disease · Mechanical ventilation · Oxygen supplementation · Patent ductus arteriosus · Preterm infant · Respiratory distress syndrome · Surfactant therapy · Thermoregulation

Abstract
Despite recent advances in the perinatal management of neonatal respiratory distress syndrome (RDS), controversies still exist. We report updated recommendations of a European Panel of expert neonatologists who developed consensus guidelines after critical examination of the most up-to-date evidence in 2007 and 2010. This second update of the guidelines is based upon published evidence up to the end of 2012. Strong evidence exists for the role of antenatal steroids in RDS prevention, but it is still not clear if the benefit of repeated courses on respiratory outcomes outweighs the risk of adverse outcomes in the short and long term. Many practices involved in preterm neonatal stabilization at birth are not evidence based, including oxygen administration and positive pressure lung inflation, and they may at times be harmful. Surfactant replacement therapy is crucial in the management of RDS but the best preparation, optimal dose and timing of administration at different gestations is not completely clear. In addition, use of very early continuous positive airway pressure (CPAP) has altered the indications for prophylactic surfactant administration. Respiratory support in the form of mechanical ventilation may be lifesaving but can cause lung injury, and protocols should be directed at avoiding mechanical ventilation where possible by using non-invasive respiratory support such as CPAP. For babies with RDS to have best outcomes, it is essential that they have optimal supportive care, including maintenance of normal body temperature, proper fluid management, good nutritional support, appropriate management of the ductus arteriosus and support of the circulation to maintain adequate tissue perfusion.

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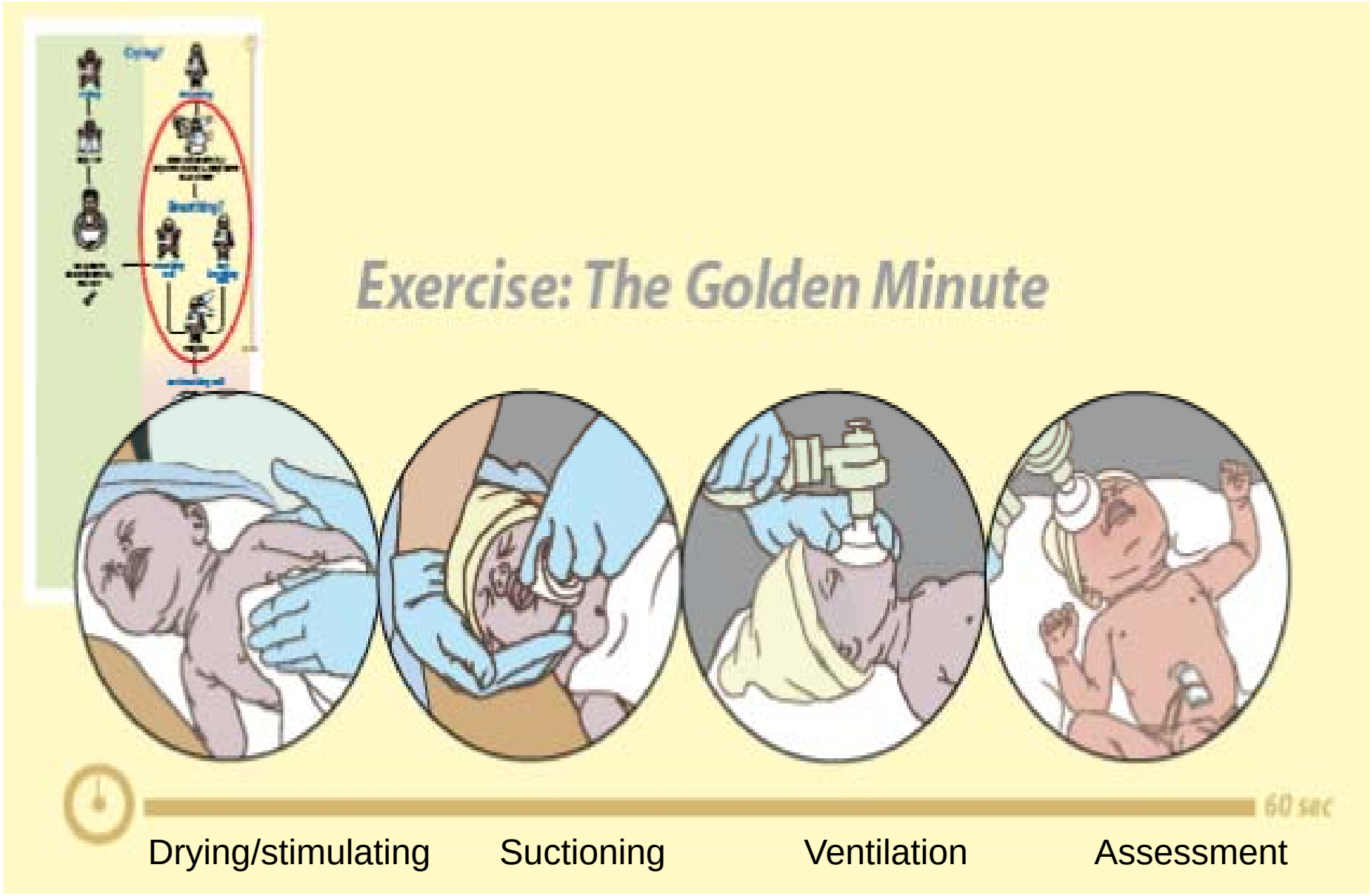
NEO349928.indd 46 15.03.2013 07:58:20

Sweet D et al Neonatology 2013;103:353-368

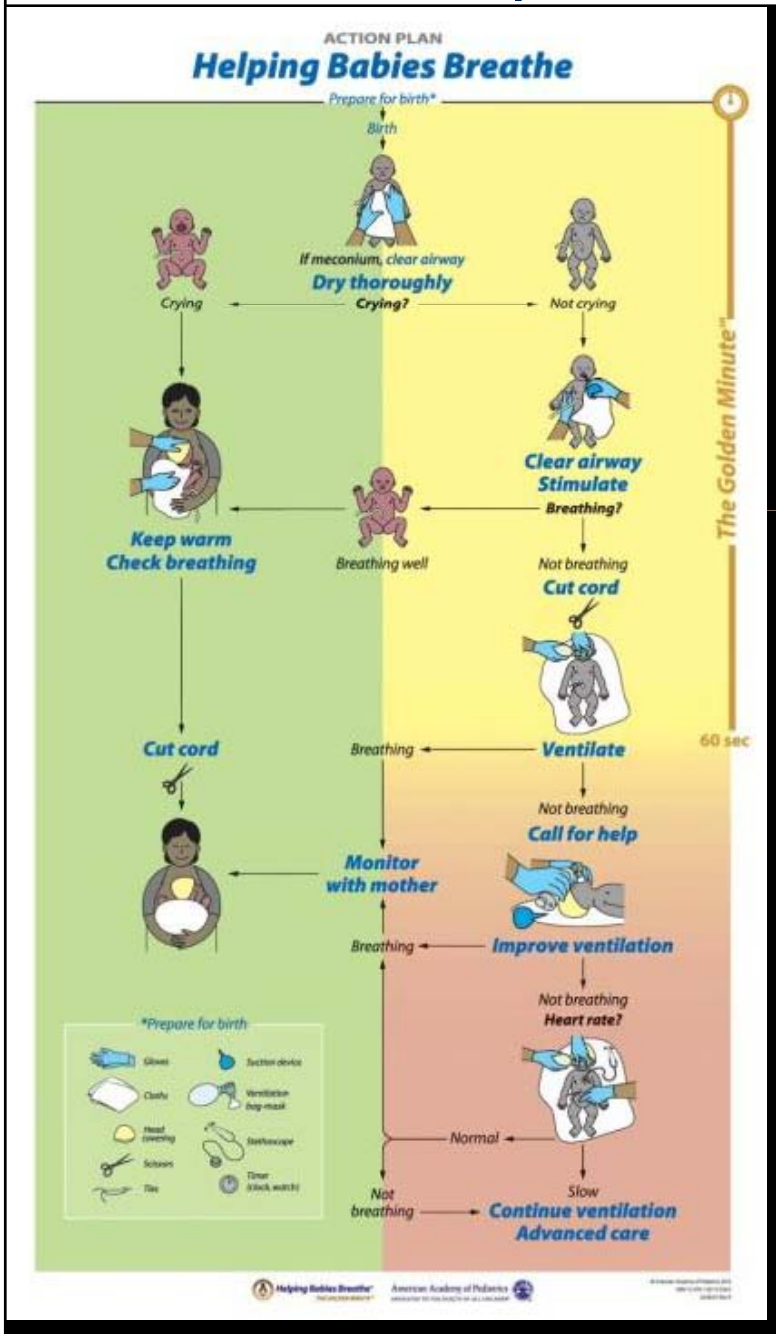
Outline of lecture

- The golden minute(s)
- Suctioning Vs wiping
- Cord clamping
- Thermal control
- Oxygenation
- CPAP/Surfactant
- Gentle resuscitation/stabilization

The Golden Minute: Helping Babies Breathe

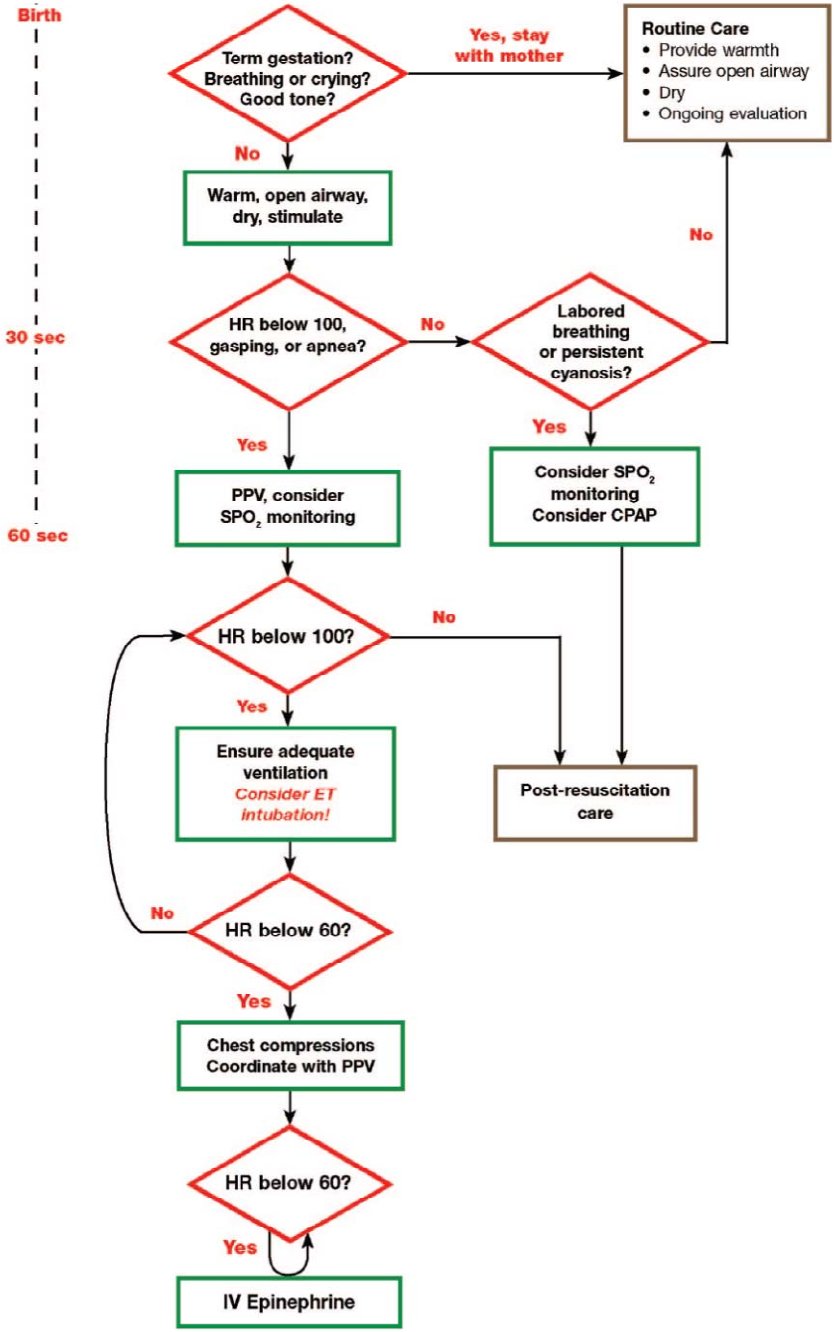


10% need help to breathe within «the golden minute»



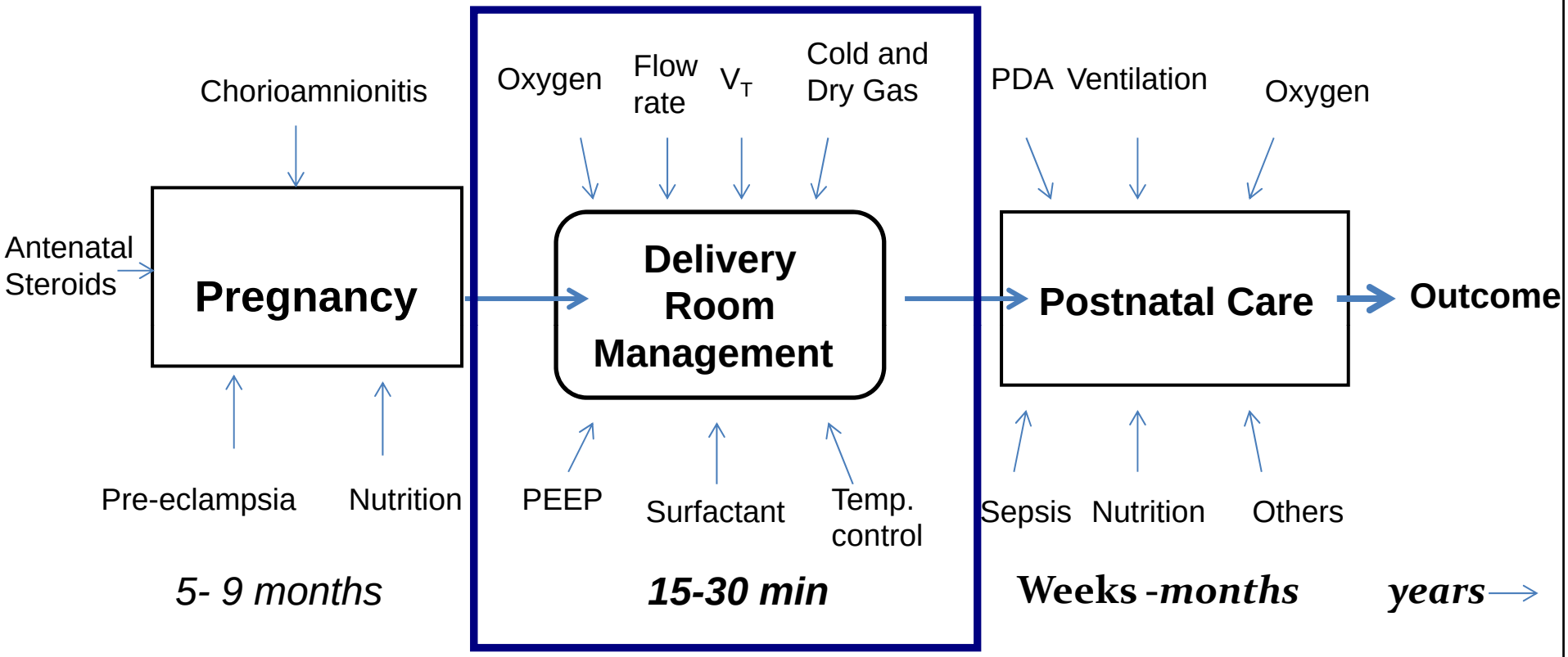
ILCOR Neonatal Resuscitation Guidelines 2010

The golden minute



Perlman J et al, Circulation 2010;122 (Suppl 2) S516-538

The Golden Minute(s)



Modified from Alan Jobe

Stabilization or resuscitation

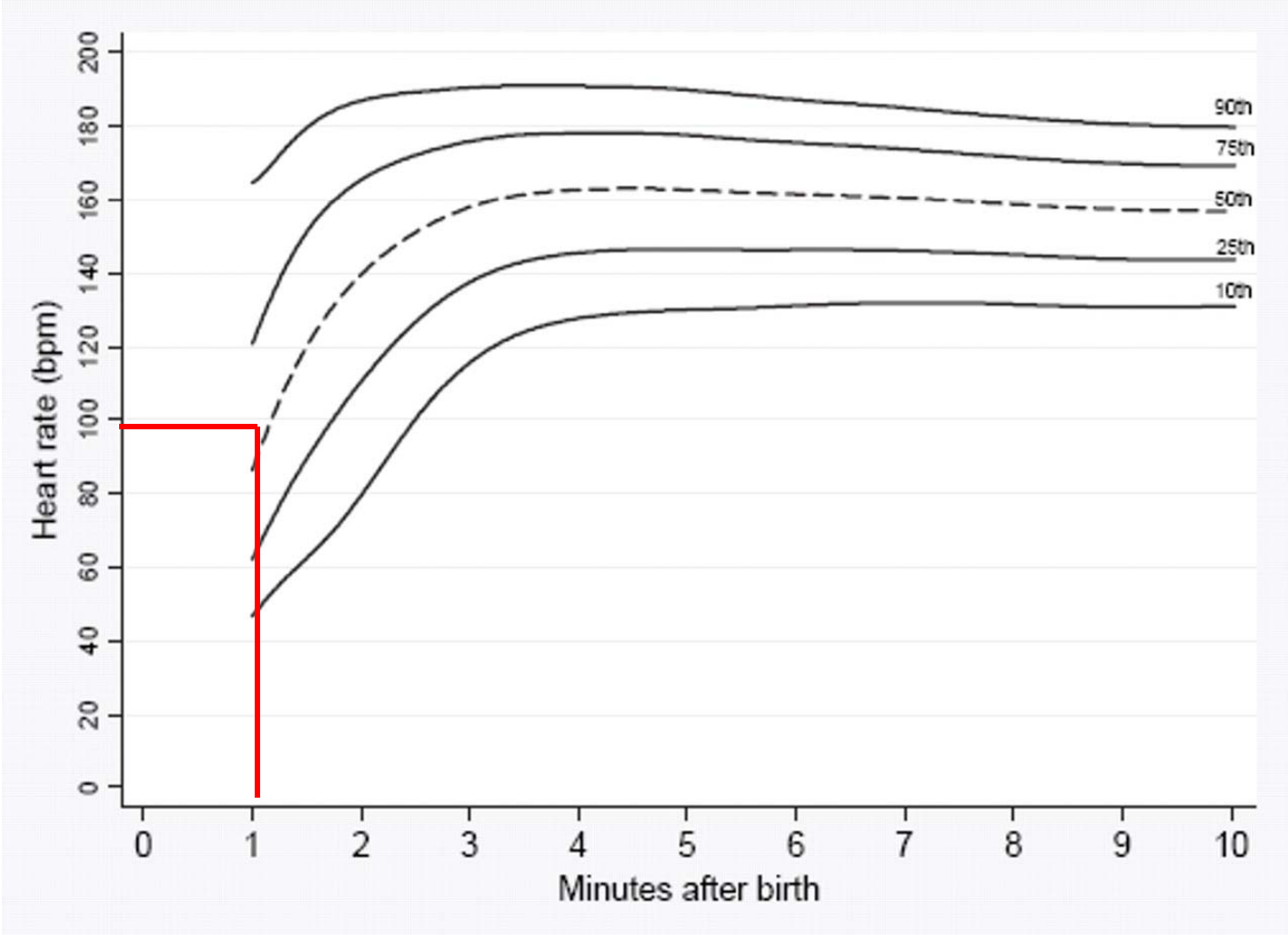
„Most premature babies are not dead and therefore do not need „resuscitation“

They need assistance in transition and adaptation

The physician is **not** the **lifesaver**, but is an **observer** and **supporter** of the infants own competences“

Angela Kribs

Development of Heart Rate in Healthy Babies First 10 minutes of Life



Dawson J et al. Arch Dis Child Fetal Neonatal Ed 2010;95:F177-F181

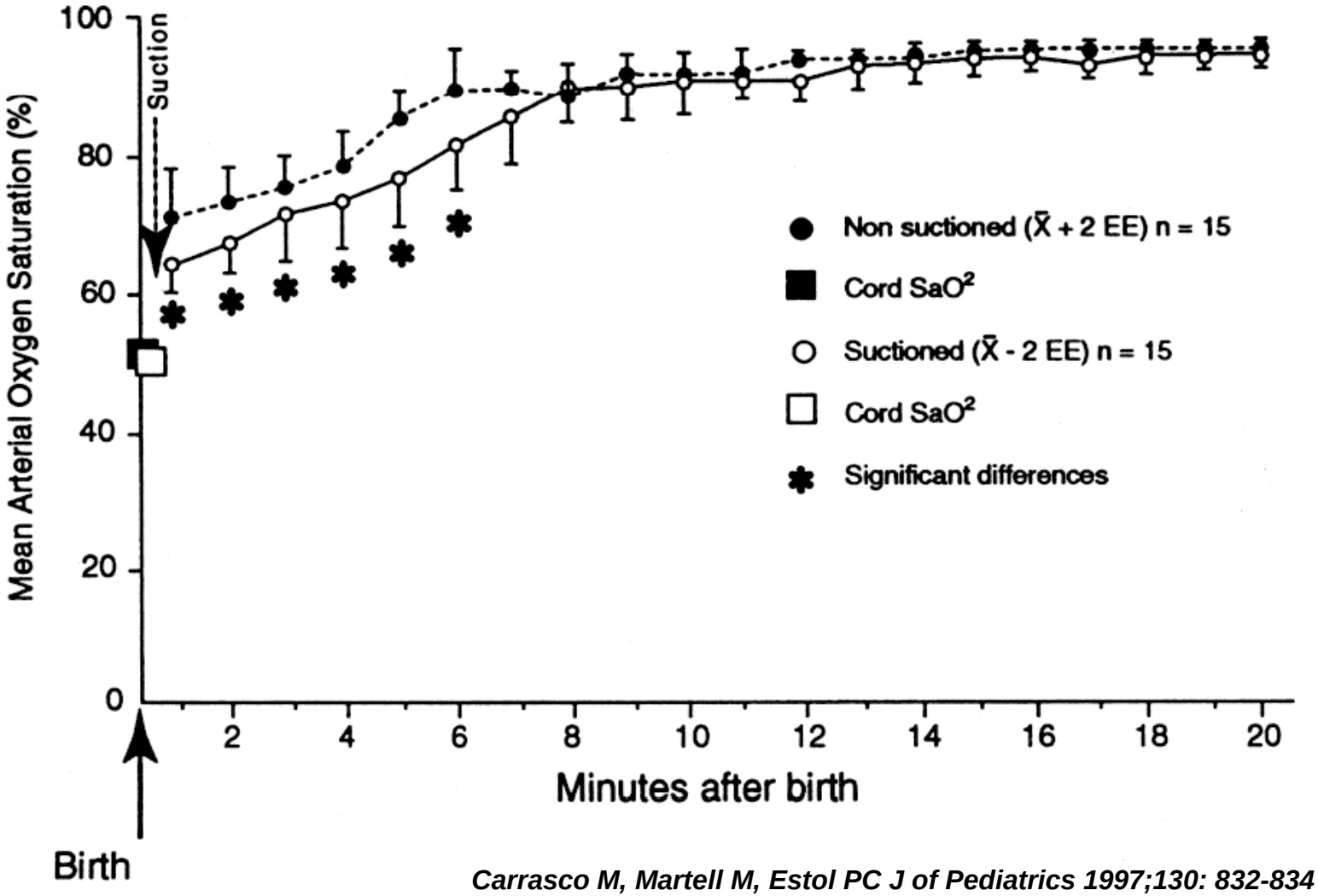
50 percentile for heart rate is 99 bpm at one min

Suctioning or Wiping

Routine intrapartum oropharyngeal and nasopharyngeal suctioning for infants born with clear or meconium stained amniotic fluid is no longer recommended

ILCOR 2010

Routine oronasopharyngeal suction reduces oxygen saturation



Carrasco M, Martell M, Estol PC J of Pediatrics 1997;130: 832-834

A controlled study of 30 normal term newborn infants. In 15 of them, oropharyngeal suction was performed immediately after birth. According to this study, oropharyngeal suction should not be performed as a routine procedure in normal, term, vaginally born infants.

Similar data were found after C- section *Gungor et al Gynecol Obstet Invest* 2006;61:9-14

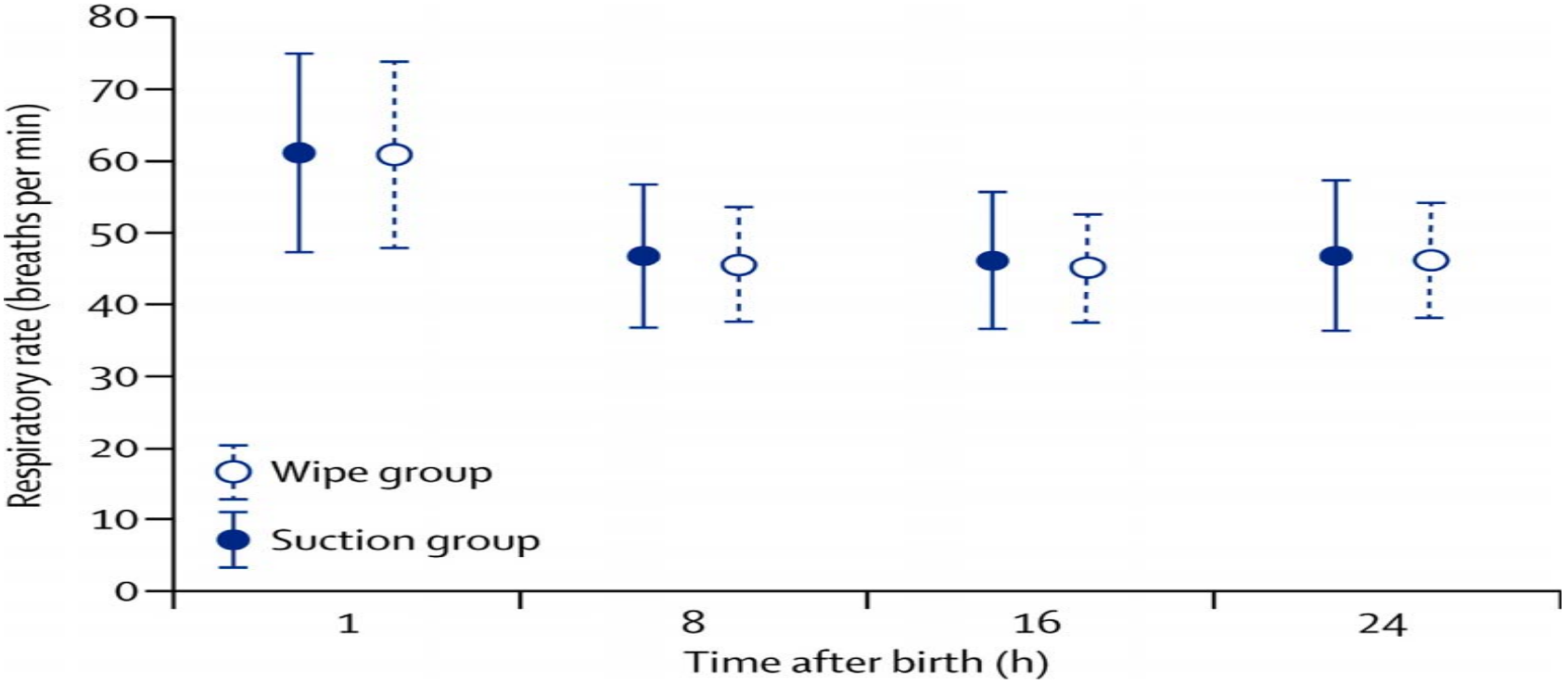
Oronasopharyngeal suction at birth:
effects on arterial oxygen saturation

	Nonsuctioned (n = 15)	Suctioned (n = 15)	p
Birth weight (gm)*	3265 ± 262	3192 ± 438	NS
Gestational age (wk)*	39 ± 1	40 ± 1	NS
Sex (F/M)	6/9	8/7	NS
Umbilical artery pH*	7.27 ± 0.09	7.27 ± 0.06	NS
Minutes to 86% saturation*	5.0 ± 1.2	8.2 ± 3.3	<0.05
Minutes to 92% saturation*	6.8 ± 1.8	10.2 ± 3.3	<0.05

NS, Not significant.
*Values represent mean ± SEM.

Carrasco M, Martell M, Estol PC J of Pediatrics 1997;130**:** 832-834

Routine wiping Vs suctioning >35 weeks GA



Respiratory rates in the first 24 h after birth Data are mean (1 SD).

John Kelleher , Ramachandra Bhat , Ariel A Salas , Dylan Addis , Emily C Mills , Himel Mallick , Arvind Tripathi ...

Oronasopharyngeal suction versus wiping of the mouth and nose at birth: a randomised equivalency trial

The Lancet null 2013 null http://dx.doi.org/10.1016/S0140-6736(13)60775-8

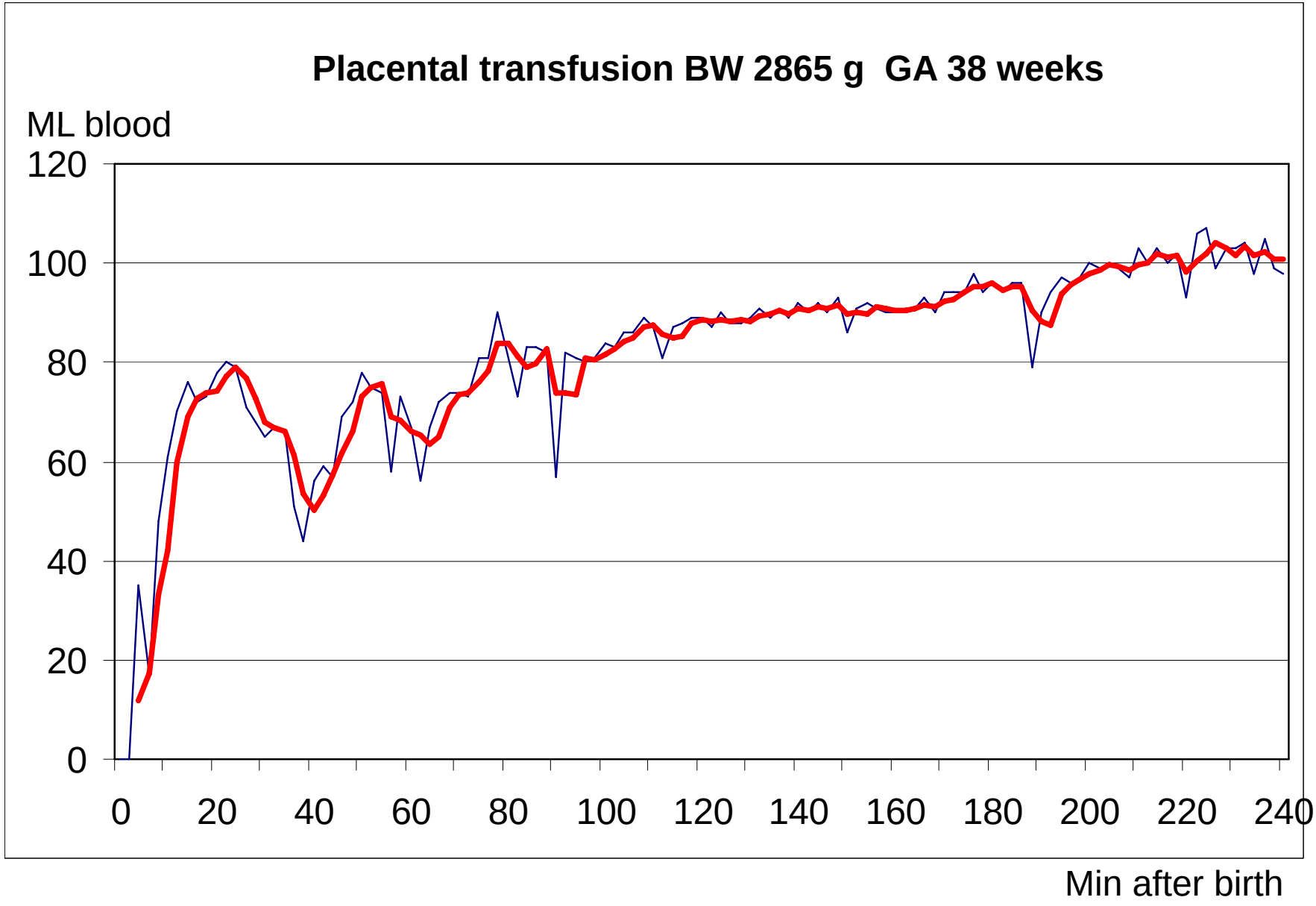
Suctioning or wiping

•A vigorous newborn who starts to breathe within 10-15 seconds does not need suctioning routinely

•Deep suctioning should be avoided especially the first 5 min of life. It may induce apnea, bradycardia and bronchospasm

•If suctioning, always suction the mouth before through the nose to minimize risk of aspiration

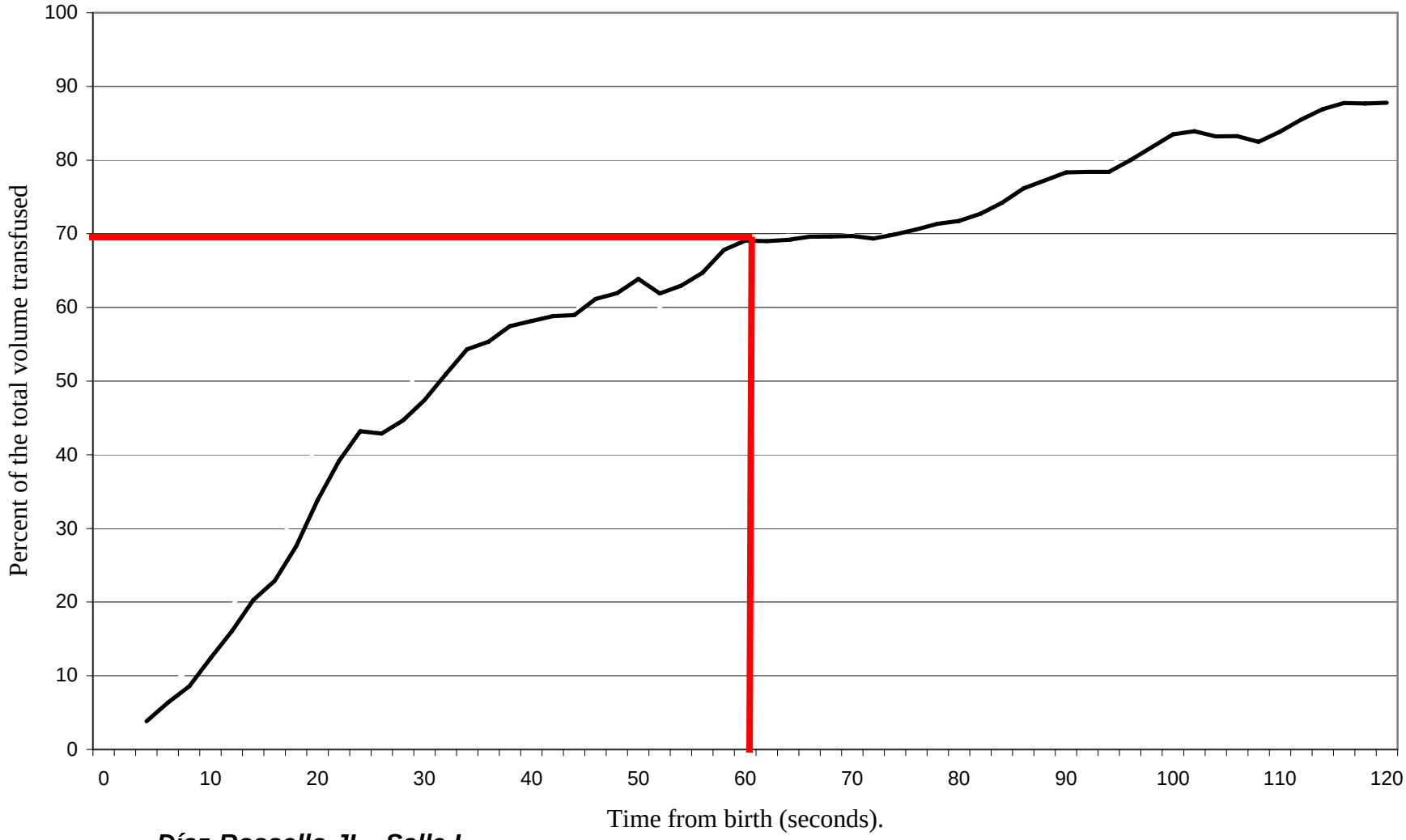
Wiping as efficient as suctioning



Díaz-Rossello JL Salle L

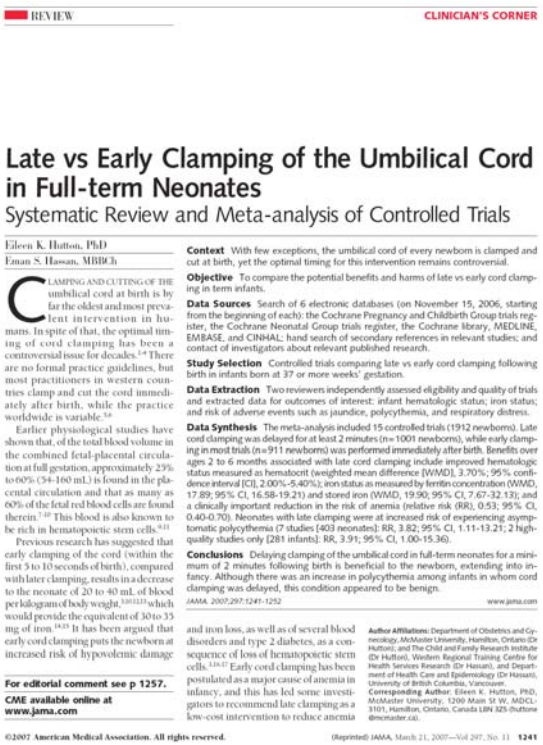
Average of accumulated percentage blood volume transfused from placenta to the infant

Average of Accumulated Percentage of Blood Volume Transfused from the placenta to the infant´s body.
(53 healthy full term infants)



Díaz-Rossello JL Salle L.

Late vs. Early Cord Clamping in Newborn Infants



REVIEW CLINICIAN'S CORNER

Late vs Early Clamping of the Umbilical Cord in Full-term Neonates

Systematic Review and Meta-analysis of Controlled Trials

Eileen K. Hutton, PhD
Enan S. Hassan, MBBCh

Context With few exceptions, the umbilical cord of every newborn is clamped and cut at birth, yet the optimal timing for this intervention remains controversial.

Objective To compare the potential benefits and harms of late vs early cord clamping in term infants.

Data Sources Search of 6 electronic databases (on November 15, 2006, starting from the beginning of each): the Cochrane Pregnancy and Childbirth Group trials register, the Cochrane Neonatal Group trials register, the Cochrane library, MEDLINE, EMBASE, and CINHAL; hand search of secondary references in relevant studies; and contact of investigators about relevant published research.

Study Selection Controlled trials comparing late vs early cord clamping following birth in infants born at 37 or more weeks' gestation.

Data Extraction Two reviewers independently assessed eligibility and quality of trials and extracted data for outcomes of interest: infant hematologic status; iron status; and risk of adverse events such as jaundice, polycythemia, and respiratory distress.

Data Synthesis The meta-analysis included 15 controlled trials (1912 newborns). Late cord clamping was delayed for at least 2 minutes (n= 1001 newborns), while early clamping in most trials (n=911 newborns) was performed immediately after birth. Benefits over ages 2 to 6 months associated with late cord clamping include improved hematologic status measured as hematocrit (weighted mean difference [WMD], 3.70%; 95% confidence interval [CI], 2.00%-5.40%); iron status as measured by ferritin concentration (WMD, 17.89; 95% CI, 16.58-19.21) and stored iron (WMD, 19.90; 95% CI, 7.67-32.13); and a clinically important reduction in the risk of anemia (relative risk (RR), 0.53; 95% CI, 0.40-0.70). Neonates with late clamping were at increased risk of experiencing asymptomatic polycythemia (7 studies [403 neonates]: RR, 3.82; 95% CI, 1.11-13.21; 2 high-quality studies only [281 infants]: RR, 3.91; 95% CI, 1.00-15.36).

Conclusions Delaying clamping of the umbilical cord in full-term neonates for a minimum of 2 minutes following birth is beneficial to the newborn, extending into infancy. Although there was an increase in polycythemia among infants in whom cord clamping was delayed, this condition appeared to be benign.

JAMA. 2007;297:1241-1252 www.jama.com

CLAMPING AND CUTTING OF THE umbilical cord at birth is by far the oldest and most prevalent intervention in humans. In spite of that, the optimal timing of cord clamping has been a controversial issue for decades.[1-4] There are no formal practice guidelines, but most practitioners in western countries clamp and cut the cord immediately after birth, while the practice worldwide is variable.[5,6]

Earlier physiological studies have shown that, of the total blood volume in the combined fetal-placental circulation at full gestation, approximately 23% to 60% (34-160 mL) is found in the placental circulation and that as many as 60% of the fetal red blood cells are found therein.[7-10] This blood is also known to be rich in hematopoietic stem cells.[8,11]

Previous research has suggested that early clamping of the cord (within the first 5 to 10 seconds of birth), compared with later clamping, results in a decrease to the neonate of 20 to 40 mL of blood per kilogram of body weight,[3,10,12,13] which would provide the equivalent of 30 to 35 mg of iron.[14,15] It has been argued that early cord clamping puts the newborn at increased risk of hypovolemic damage and iron loss, as well as of several blood disorders and type 2 diabetes, as a consequence of loss of hematopoietic stem cells.[3,16,17] Early cord clamping has been postulated as a major cause of anemia in infancy, and this has led some investigators to recommend late clamping as a low-cost intervention to reduce anemia

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For editorial comment see p 1257.

CME available online at www.jama.com

15 controlled studies, 1912 term newborn

<u>After 2-6 months:</u>

- Higher hematocrit
- Improved iron status
- Reduced risk of anemia
- Increased risk of asymptomatic polycythemia

Conclusion:

"Delaying clamping of the cord in full term neonates for a minimum of 2 minutes following birth is beneficial to the newborn extending into infancy"

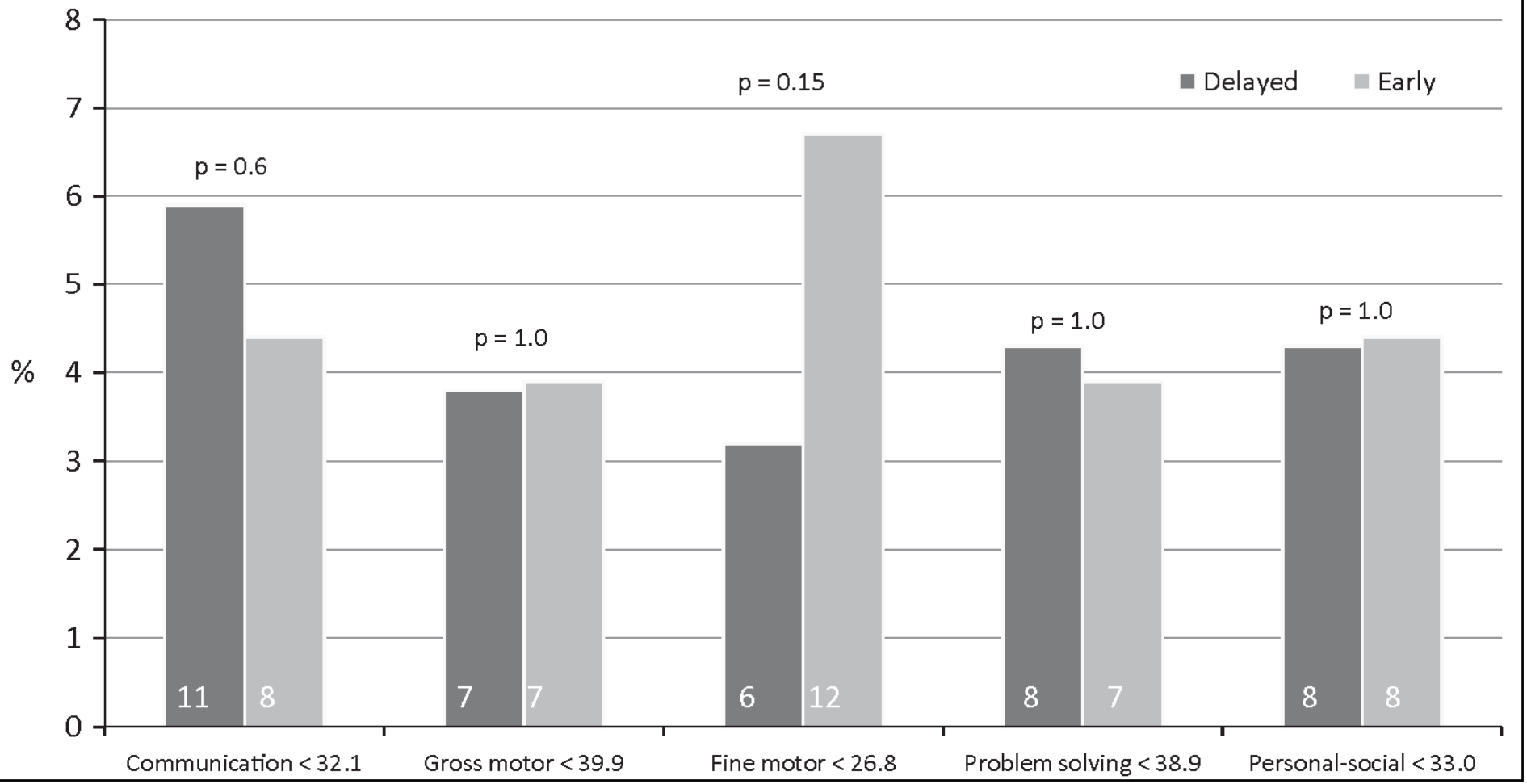
Hutton,E, Hassan E. JAMA 2007; 297:1241-52

Acta Pædiatrica ISSN 0803-5253

REGULAR ARTICLE

Effects of delayed cord clamping on neurodevelopment and infection at four months of age: a randomised trial

Ola Andersson (ola.k.andersson@regionhalland.se)[1,2], Magnus Domellöf[3], Dan Andersson[1], Lena Hellström-Westas[2]



Cord Clamping in Preterm

Half the blood volume in the placenta
Meta analysis of 15 studies of delayed cord clamping gives:
- **Increased blood volume**
- **Less need of transfusions**
- **Less NEC**
- **Reduction in IVH (nearly 50%)**

Rabe H et al, Cochrane database systematic review 2012;(8):CD003248

At least 30 s of delayed cord clamping is safe to use and does not compromise the preterm infant in the initial post-partum adaptation phase.

Rabe H, Reynolds G, Diaz-Rossello JL Neonatology 2008;93:138 -194

European Guidelines for RDS 2013:

Aim to delay cord clamping at least 45 sec
Sweet D et al Neonatology 2013;103:353-368

Cord clamping

"In newly-born term or preterm babies who do not require positive –pressure ventilation, the cord should not be clamped earlier than one minute* after birth. When newly-born term or preterm babies require positive-pressure ventilation, the cord should be clamped and cut to allow effective ventilation to be performed."

***Should be understood as the lower limit supported by published evidence. Normally around 3 minutes necessary for applying cord traction**

WHO 2012: Basic Newborn Resuscitation

"Cord clamping should be delayed for at least 1 minute in babies who do not require resuscitation. Evidence is insufficient to recommend a time for clamping in those who require resuscitation"

ILCOR Guidelines 2010 from Perlman et al, 2010

Delaying cord clamping until ventilation onset improves cardiovascular function at birth in preterm lambs.

Lambs were delivered at 126 ± 1 days and:

(1) the umbilical cord was clamped at delivery and ventilation was delayed for about 2 min.

cord clamping reduced heart rate (by ~40%) and right ventricular output from 114.6 ± 14.4 to 38.8 ± 9.7 ml min(-1) kg(-1)), which were restored by ventilation.

(2) umbilical cord clamping was delayed for 3-4 min, until after ventilation was established. Cord clamping reduced right ventricular output from 153.5 ± 3.8 to 119.2 ± 10.6 ml min(-1) kg(-1), and did not affect heart rates.

Delaying cord clamping for 3-4 min until after ventilation is established improves cardiovascular function by increasing pulmonary blood flow before the cord is clamped. As a result, cardiac output remains stable, leading to a smoother cardiovascular transition throughout the early newborn period.

Bhatt S et al J Physiol. 2013 Apr 15;591:2113-26

Heart rate following

early clamping

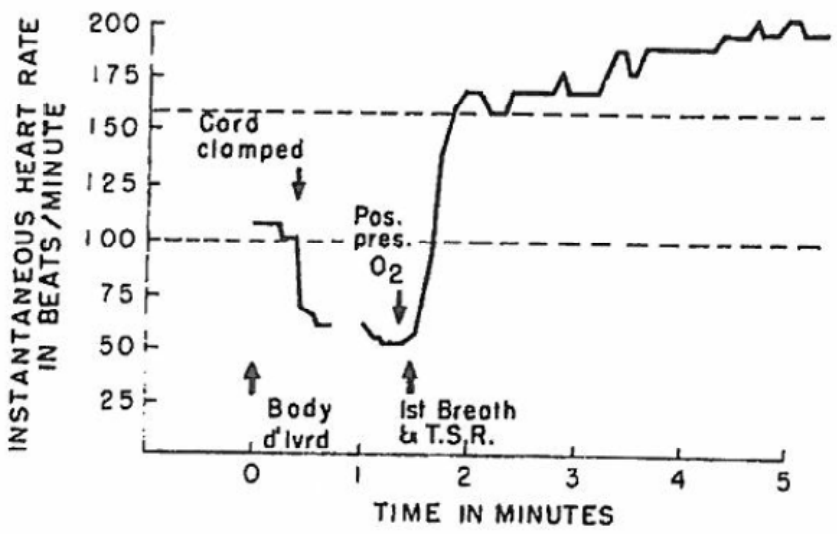


Fig. 6. Mildly depressed infant—No. 89. Onset of respiration after cord clamping and oxygen administration. Heart rate fell from 100 to 68 immediately after clamps were applied and rose to 167 with lung expansion. Score 5.

late clamping

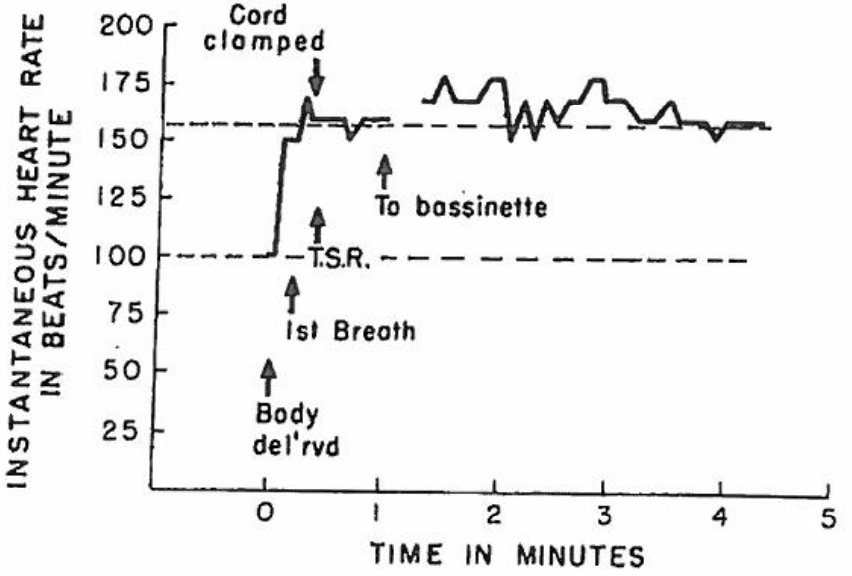
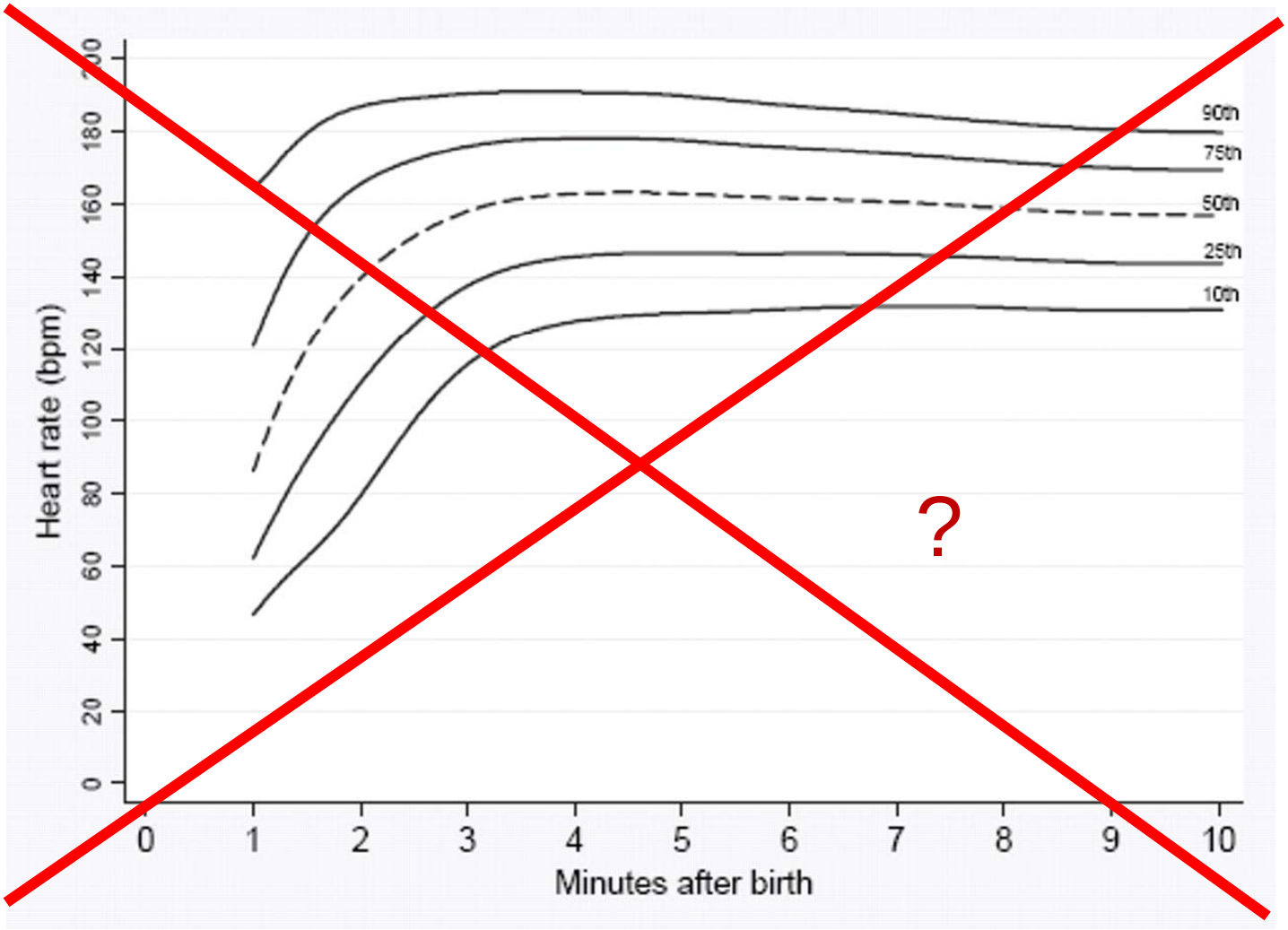


Fig. 5. Vigorous infant—No. 108. Score 8. Onset of respiration occurred before cord was clamped and heart rate of 158 was unaltered by clamping.

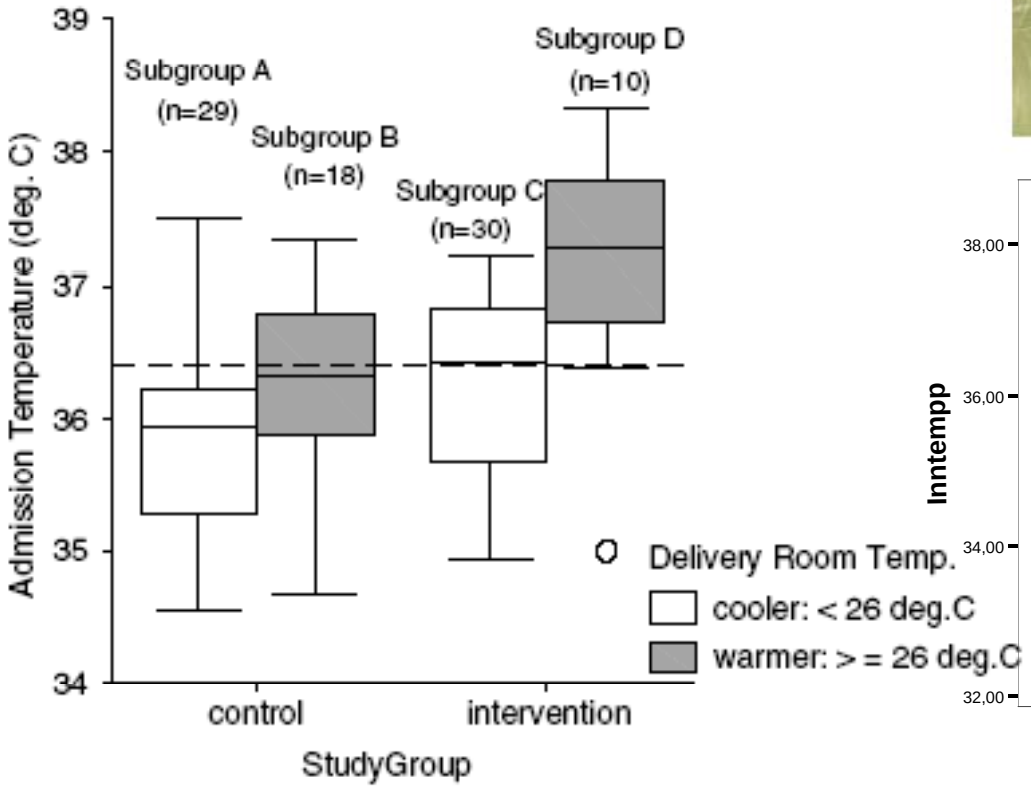
JP Brady and LS James Am Obst Gyn 1962; 84:1-12

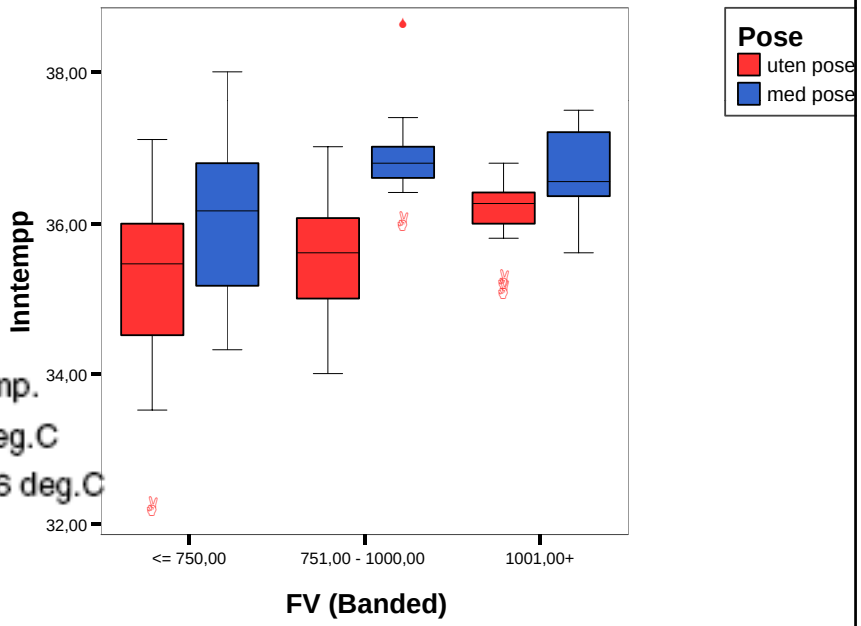
The 10th, 25th, 50th, 75th and 90th heart rate centiles for all infants with no medical intervention after birth. bpm, beats per minute.



Dawson J et al. Arch Dis Child Fetal Neonatal Ed 2010;95:F177-F181

Preventing heat loss





Robin B, Knobel J Perinatal 2005

Silberg IE,
NICU, Oslo University Hospital

OXYGEN

ESSENTIAL FOR LIFE

VS

POTENTIALLY TOXIC AND MUTAGENIC

- It is completely available
- It can easily diffuse accross biological membrane
- It can bind heme in protein (Hemoglobin and Cytocrome)

Over production of Free Radicals

Oxidative stress

Solberg R et al The Journal of Maternal-Fetal and Neonatal Medicine, 2012; 25(S(1)): 41–44

All babies are born blue and it takes time to have a vivid color

ILCOR 2010: Oxygenation

Treatment Recommendation:

•In term infants receiving resuscitation at birth with positive pressure ventilation,
it is best to begin with air rather than 100% oxygen.

•Because many preterm babies < 32 weeks' gestation will not reach target saturations in air, blended oxygen and air may be given judiciously and ideally guided by pulse oximetry.

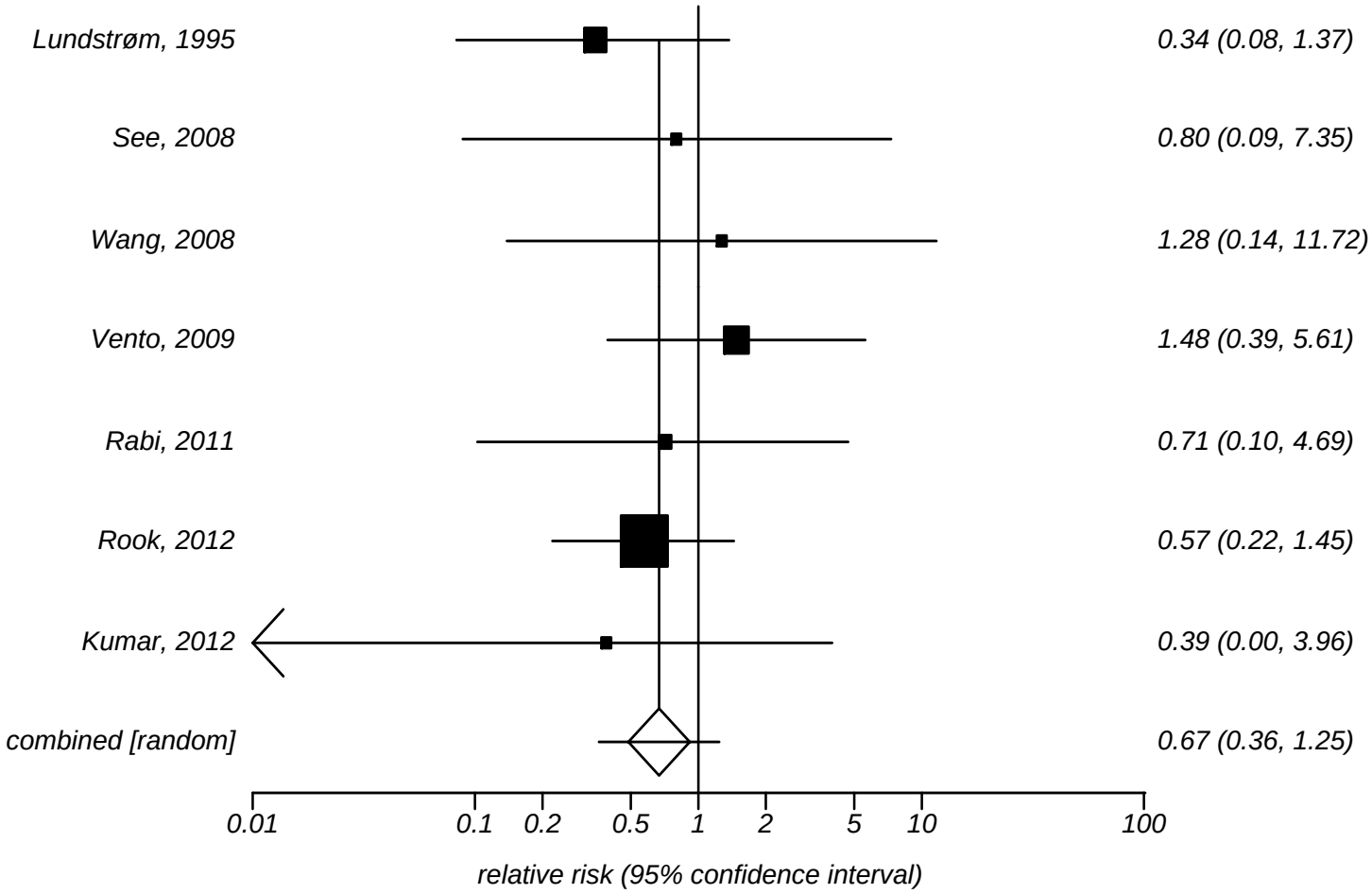
•Both hyperoxemia and hypoxemia should be avoided.

•If a blend of oxygen and air is not available, resuscitation of preterm infants should be initiated with air

Perlman et al, Circulation 2010;122;S 516-S538

Mortality in low versus high i FiO_2

Relative risk meta-analysis plot (random effects)



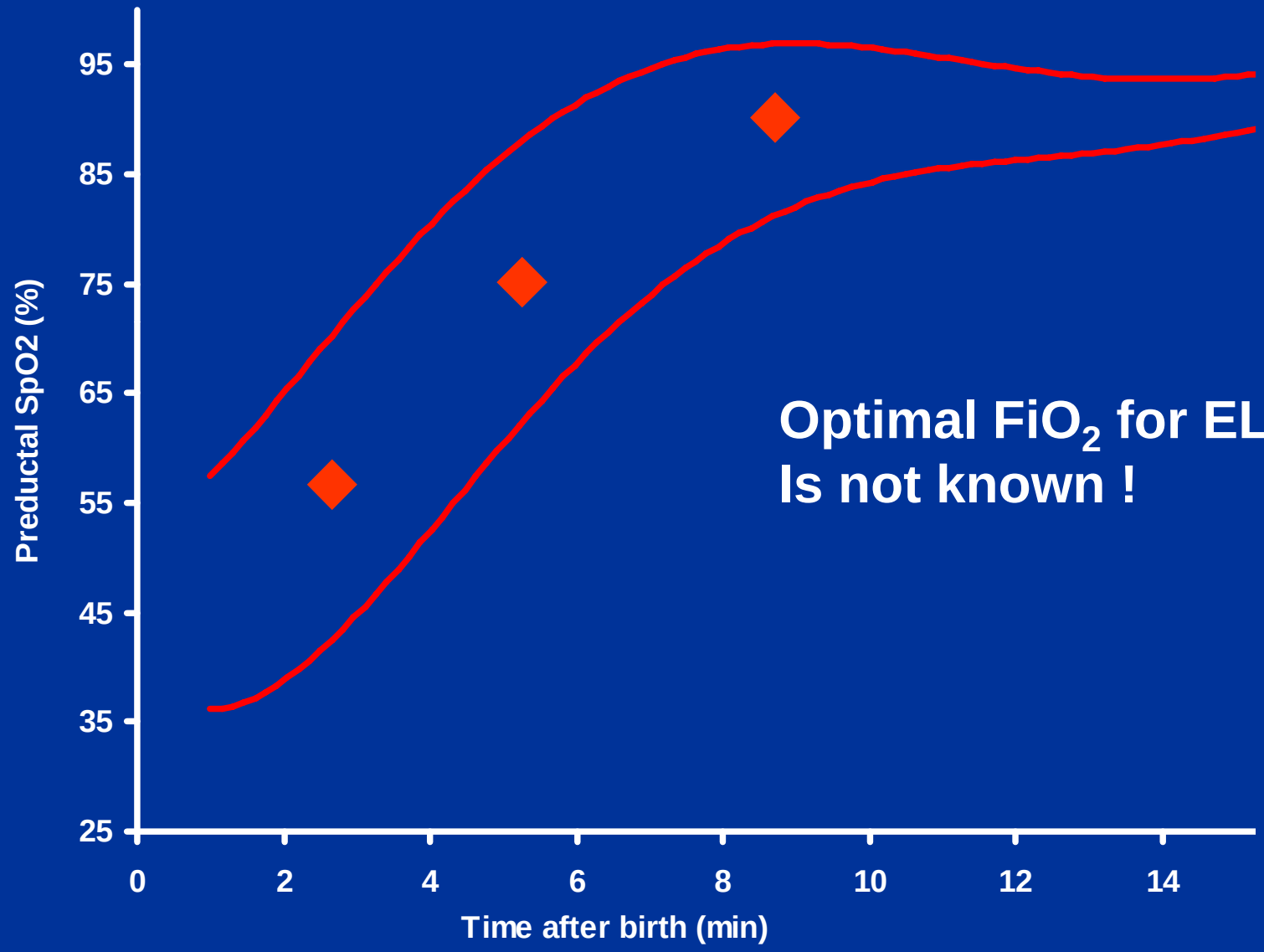
Saugstad, Aune, Finer, Vento submitted

Appropriate use of supplemental oxygen

Obtain a pulse oximetry reading by two minutes of life and continuously monitor the heart rate and oxygen saturation

SpO_2 polynomial adjustment curve in "control" ELBWIs ≤ 28 w GA

(n=29, ± SD)



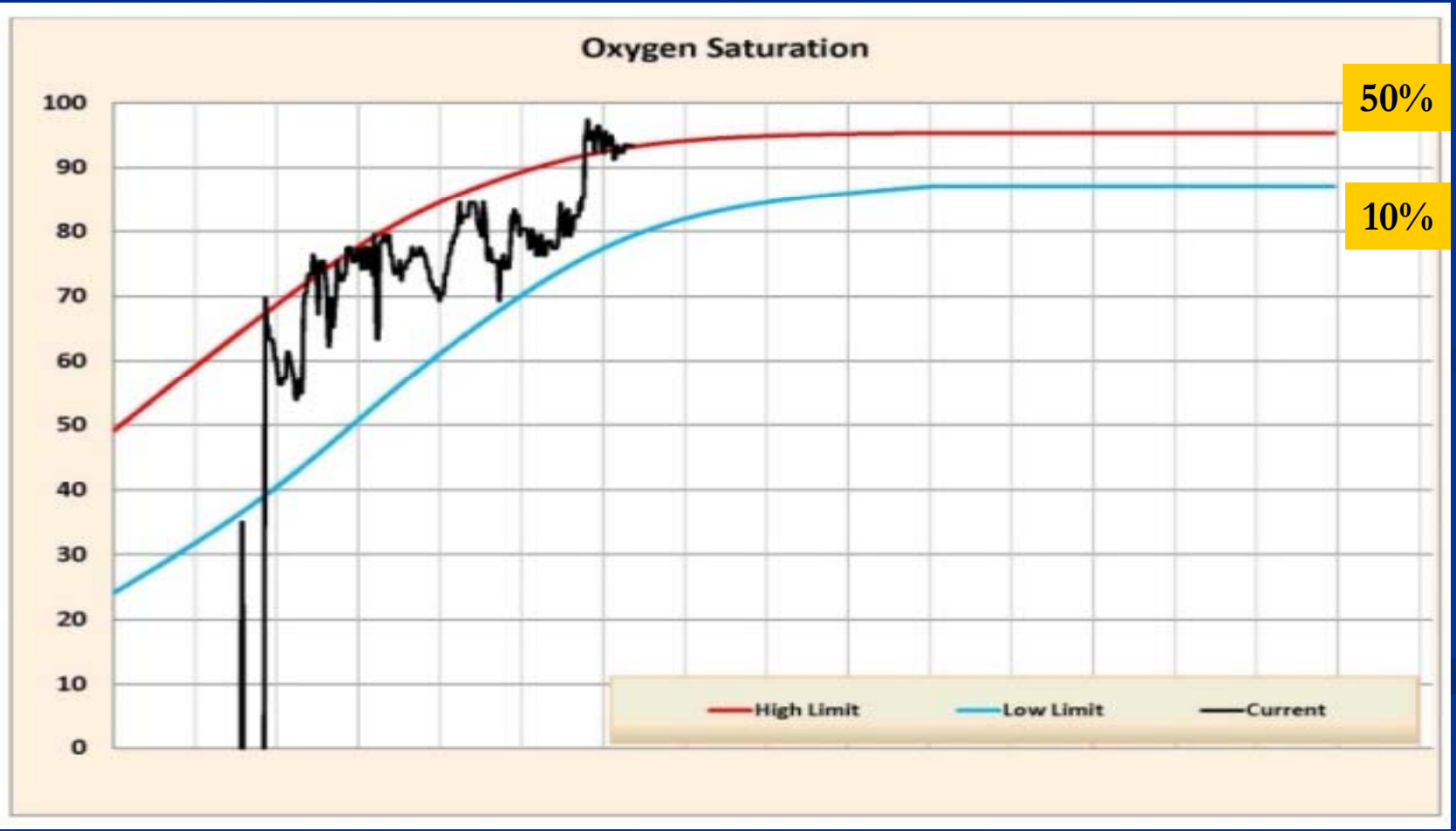
Optimal FiO_2 for ELBWI Is not known !

Vento M, Saugstad OD SFNM 2010

Resuscitation of preterm infants < 33 weeks GA:

Start low (21-30% O_2)

Adjust FiO_2 according to preductal SpO_2 allowing to individualize FiO_2 avoiding hyper/hypoxia



Rich W et al ,2011

CPAP for stabilisation

CPAP or Surfactant Vs Surfactant and CPAP

Delivery room management of premature infants

What is the best approach to take in the stabilization of premature infants at high risk of developing respiratory distress syndrome?

- Should we use sustained inflation and/or PEEP?
- Delivery room intubation and prophylactic surfactant administration with continued ventilatory support?
- Delivery room intubation and prophylactic surfactant administration without continued ventilator support?
- Early stabilization on nasal continuous positive airway pressure?

Sustained inflation and PEEP

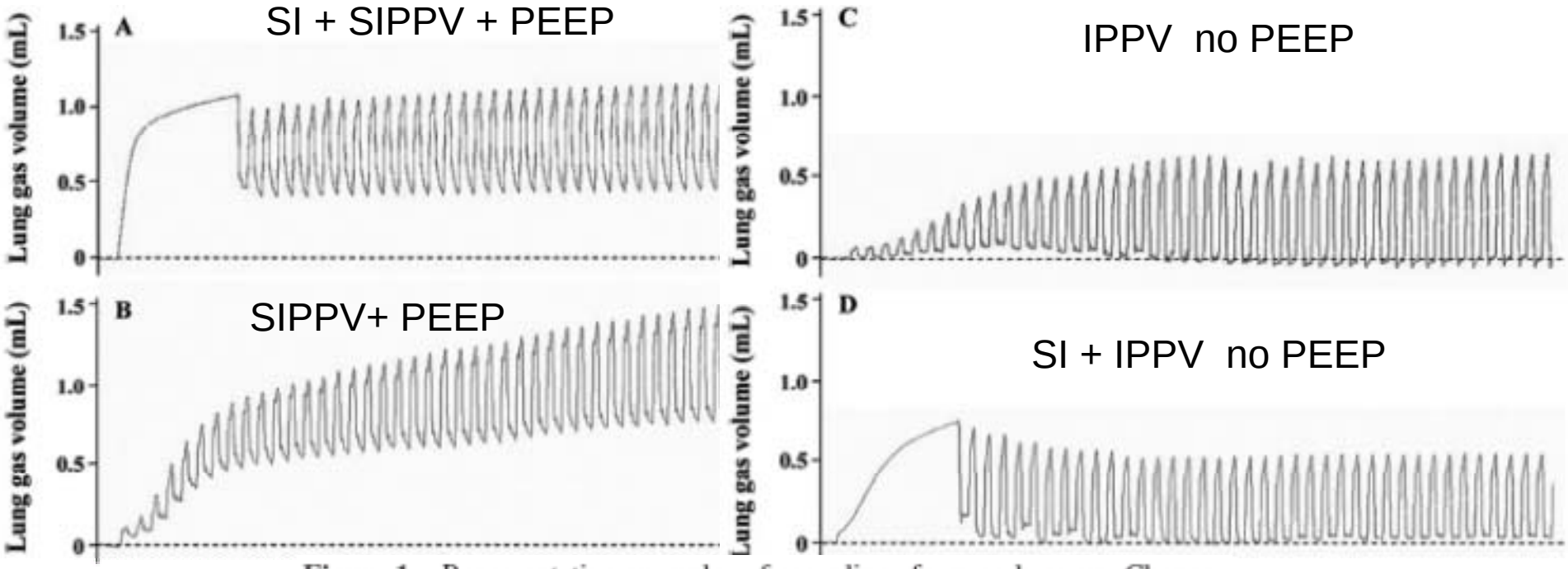


Figure 1. Representative examples of recordings from each group. Change in lung gas volume from birth in anesthetized ventilated preterm rabbit pups using plethysmography. With PEEP (*A* and *B*), an end-expiratory gas volume (FRC) was rapidly formed whereas in the absence of PEEP a significant FRC was not formed (*C* and *D*).

Te Pas et al. *Pediatr Res 65: 537-541, 2009*

Clinical data are needed

CPAP Vs Prophylactic Surfactant

CURPAP

- 208 babies 25 to 28 weeks' gestation
- Randomised to CPAP alone or surfactant followed by extubation to CPAP within 30 mins
- 78% of babies survived without BPD in both groups
- Suggests that prophylactic surfactant not superior to early CPAP and rescue surfactant

Sandri F, et al
Prophylactic or early selective surfactant combined with nCPAP in very preterm infants.
CURPAP Study Group Pediatrics. 2010 Jun;125(6):e1402-9. Epub 2010 May 3.

SUPPORT

- 1316 babies 24-27 weeks' randomised to intubation and surfactant or CPAP within 1 h

	CPAP	INTUBATE & SURF	P-VALUE
Surfactant	67%	99%	
Vent days	25	28	0.03
Steroids for BPD	7.2%	13.2%	0.001
Death/BPD	48%	51%	0.3

However population in both arms did better than non – recruited eligible babies

Finer et al NEJM 2010

Why avoid Surfactant prophylaxis?

- Surfactant requires intubation
- Often results in babies being “bagged” and mechanical ventilation being used
- Studies showing benefits of prophylaxis was done in an era of low antenatal steroid use and minimal use of CPAP

European RDS Guidelines 2013

Recommendations

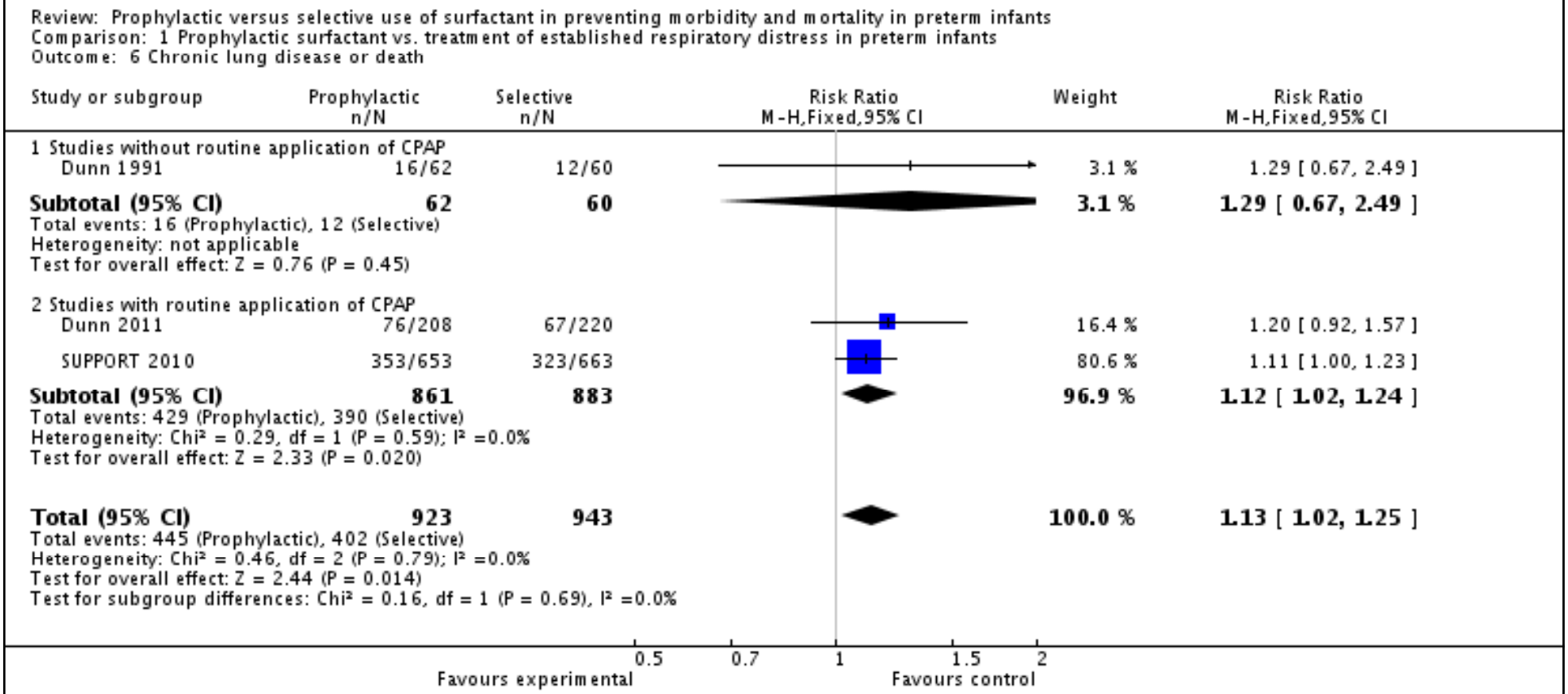
- CPAP should be started from birth in all babies at risk of RDS, such as those < 30 wk's not needing MV, until clinical status can be assessed **(A).**
- The system delivering CPAP is of little importance. Short binasal prongs should be used rather than a single prong and a pressure of at least 6 cm water should be used **(A).**
- CPAP with early rescue surfactant should be considered in babies with RDS **(A).**
- A trial of NIPPV can be considered in babies failing on CPAP, but may not offer any significant long term advantages (**A**)

Sweet D et al Neonatology 2013;103:353-368

Cochrane Meta-analysis

surfactant prophylaxis in current CPAP era

Chronic lung disease or death



Rojas-Reyes MX Cochrane 2012

European RDS Guidelines 2013

Surfactant Therapy - Recommendations

- Babies with RDS should be given a natural surfactant preparation as early as possible **(A).**
- A policy of early rescue rather than prophylaxis should be standard, with the caveat that some babies may need "rescue" in the delivery suite **(A)**
- Babies should be treated with rescue surfactant early in the course of disease. Suggested protocol is to treat babies < 26 week's when FiO2 > 30% and > 26 week's when FiO2 > 40% **(B).**
- Poractant alfa 200 mg/kg is better than 100 mg/kg of poractant or beractant for rescue therapy **(A).**
- Aim where possible to use INSURE technique **(B).**
- A 2nd/ 3rd dose should be given if ongoing evidence of RDS such as persistent oxygen or MV need **(A).**

Sweet D et al Neonatology 2013;103:353-368

European RDS Guidelines 2013

Delivery Room Stabilisation – Recommendations

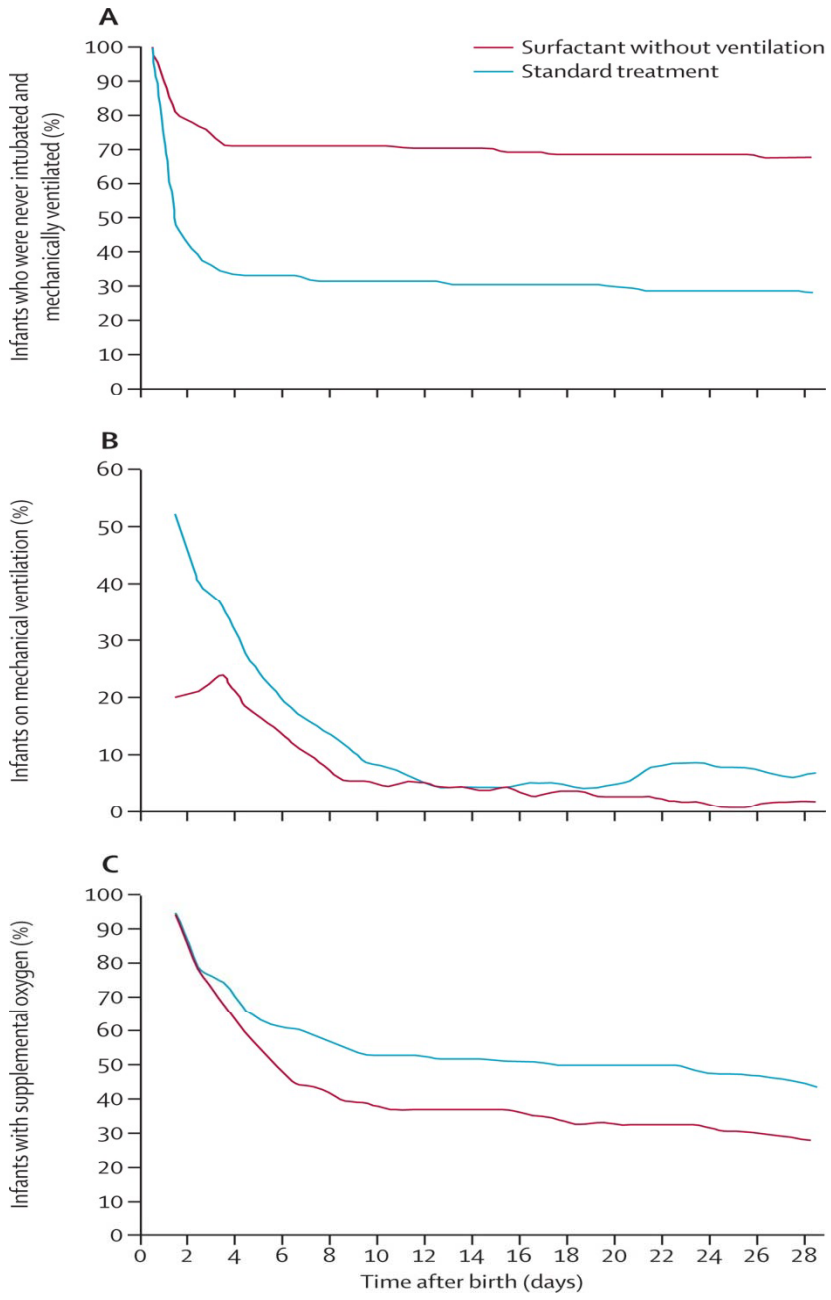
- If possible, delay cord clamping for at least 60 sec **(A).**
- Oxygen should be controlled with a blender. Use 21-30% oxygen to start and titrate using pulse oximetry, remembering normal saturations at birth may be 40-60%, reaching 50-80% by 5 min but should be >85% by 10 min. **(B).**
- If spontaneous breathing, stabilise with CPAP of 5-6 cm water via mask or prongs **(A).**
- Intubation reserved for babies who have not responded to positive pressure ventilation via a face mask **(A)**. Babies who require intubation should be given surfactant **(A).**
- Plastic bags under radiant warmers should be used during stabilisation for babies < 28 weeks' to reduce hypothermia **(A)**
- Babies should be switched to servo-controlled temperature within 10 minutes to avoid overheating (B)

Sweet D et al Neonatology 2013;103:353-368

A gentle approach ?

”Don’t just do something, stand there”

Alan Jobe 2005



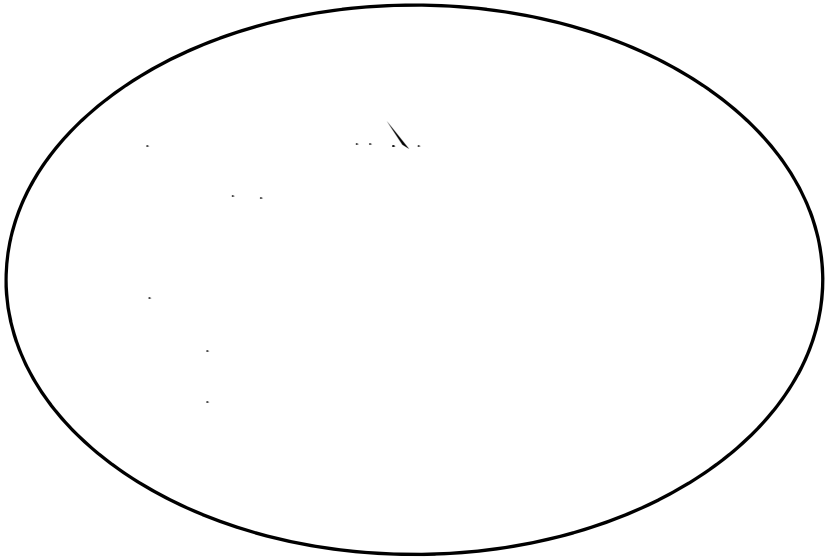
Göpel et al. Lancet 2011

Karolinska Institutet

A. MV during day 2-3 reduced from 46 to 28%, NNT 6

B. Any MV 73 vs 33%

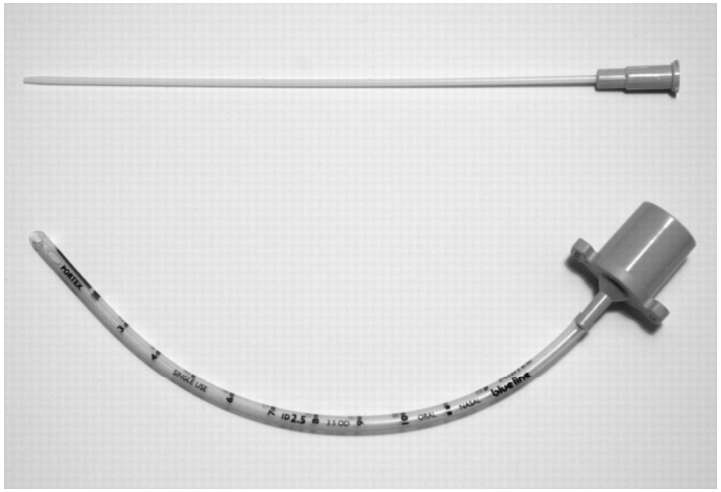
C. O2 at 28 days 46 vs 30% (no diff 36 w)



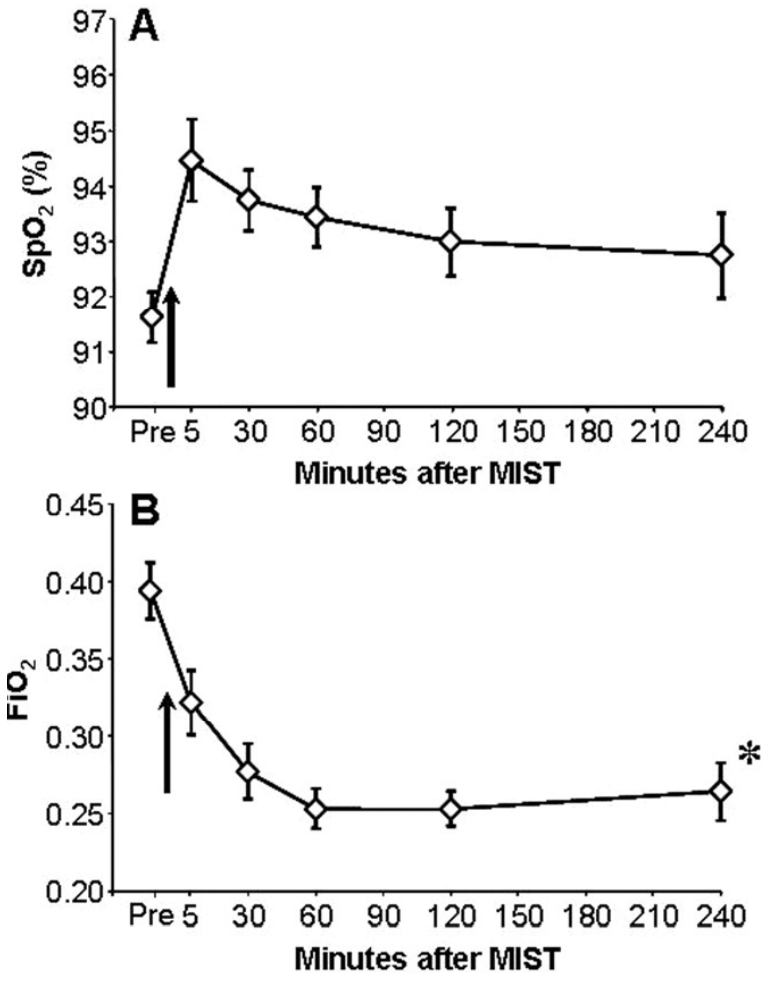
MIST – Minimally Invasive Surfactant Therapy

Dargaville PA et al ADC-FNN, 2010

Feasibility trial, 25 infants, 25 – 34 weeks
Semirigid vascular catheter



- Surfactant successfuly administered in all infants
- 2 attempts in 32% (in GA 29-34 weeks 43%)



Conclusions and Summary

•Stabilisation or resuscitation
Most newborn are not dead, they need stablisation

•Suctioning
Sucitioning is not recommended routinely . Wiping mouth and nose is most often sufficient

•Cord clamping
Late cord clamping is recommended wait till after first breath – following birth asphyxia is not known

•Thermal control
Thermal control is important – wrap ELGANs into plastic bags

•Oxygenation
Term babies: start with 21%. ELGANs Start with 21% or 30%. Do not hyperoxygenate the newborn

•Early ventilation
CPAP and then surfactant if needed more efficient than surfactant and then CPAP

•Gentle Resuscitation
Needs more research, very promising techniques

Thank you!

Welcome to Norway