Newborn Resuscitation

Filling the gaps - *filling the gasps*

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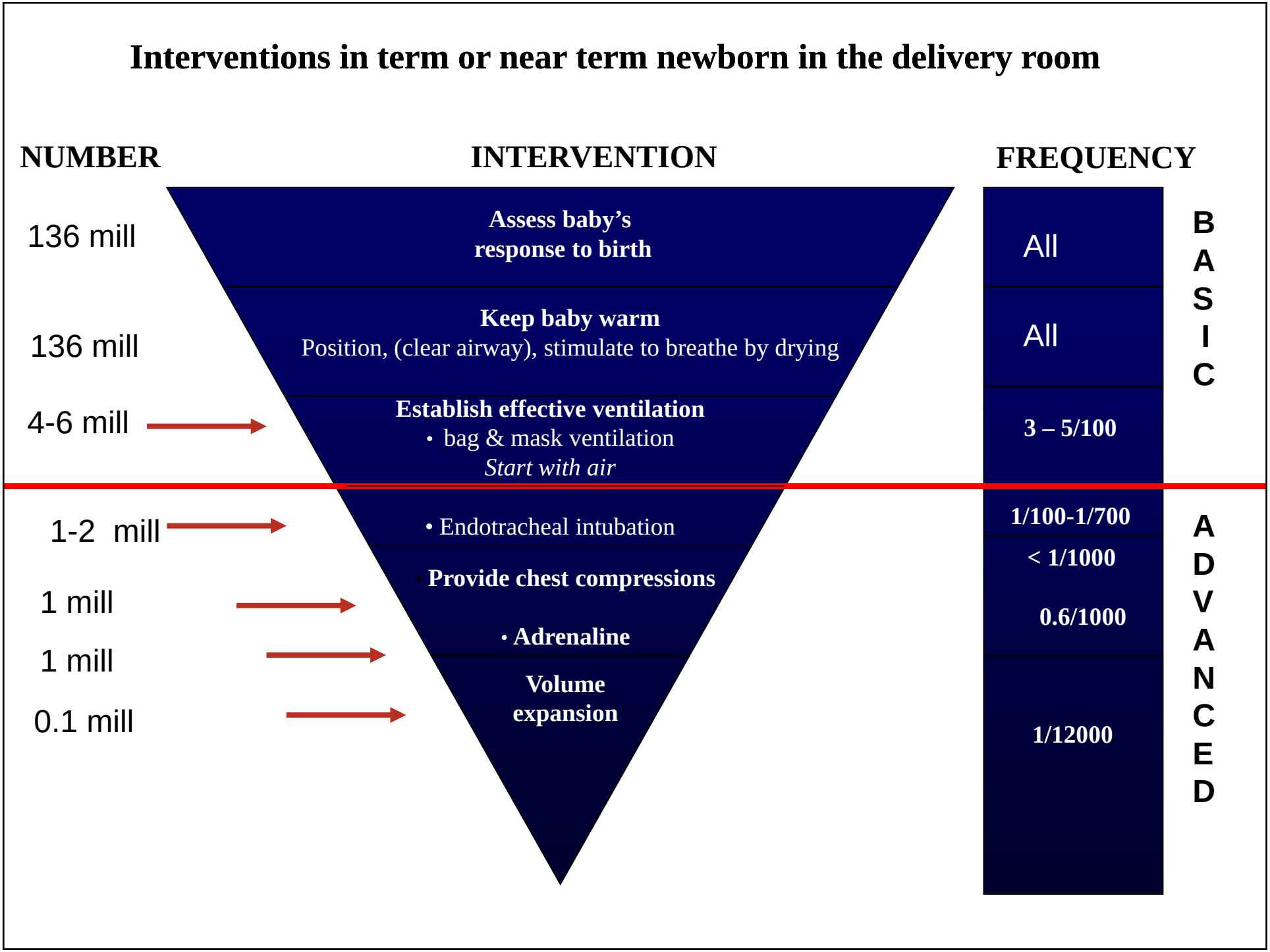
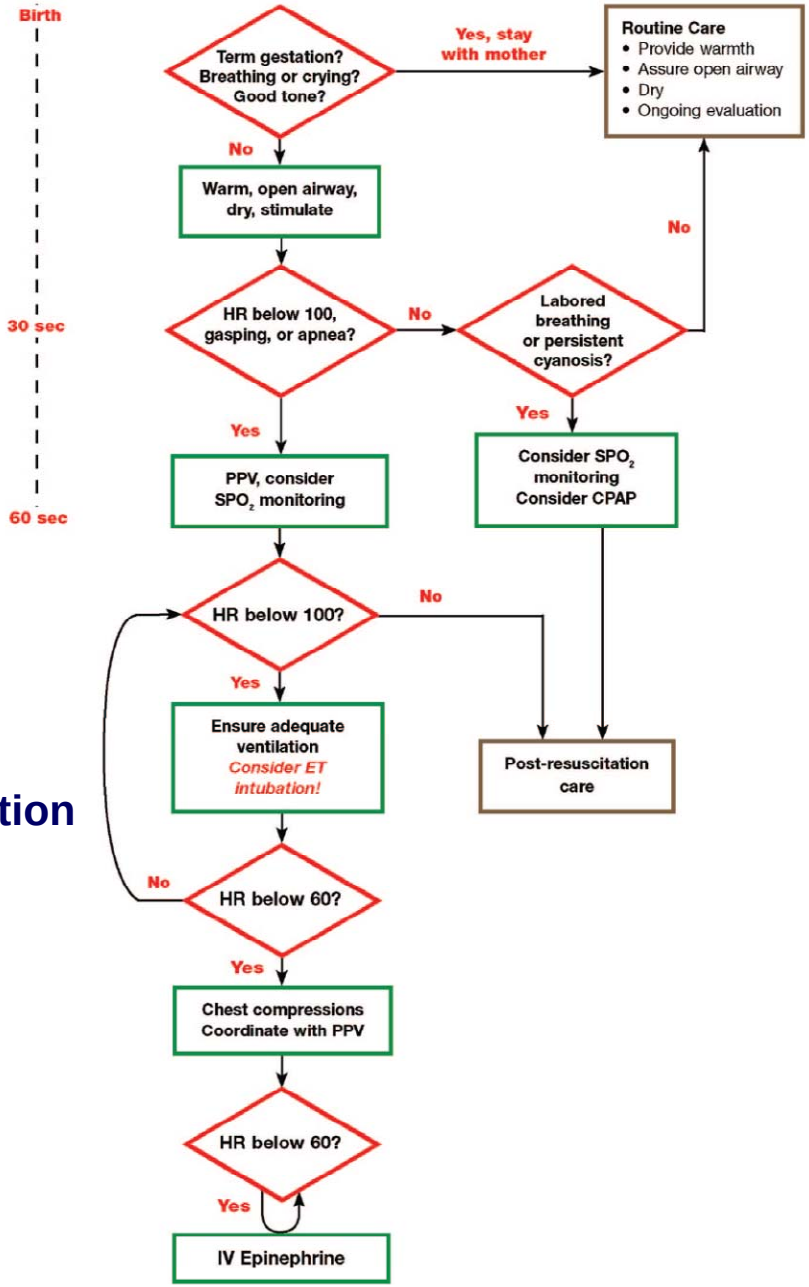
Interventions in term or near term newborn in the delivery room



ILCOR Neonatal Resuscitation Guidelines 2010

Some key changes 2005 to 2010

- **Criteria for assessment are simplified: 1) heart rate, 2) respiration**
- **No timing after 60 seconds**
- **It is best to start with air rather than 100% oxygen**
- **No evidence to support or refute routine suctioning in meconium aspiration**
- **Therapeutic hypothermia should be considered**



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

Review article

Neonatal resuscitation: In pursuit of evidence gaps in knowledge☆

Jeffrey Perlman[a,*], John Kattwinkel[b], Jonathan Wyllie[c], Ruth Guinsburg[d], Sithembiso Velaphi[e],

VIEWPOINT ARTICLE

New guidelines for newborn resuscitation – a critical evaluation

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The 2010 Guidelines on Neonatal Resuscitation (AHA, ERC, ILCOR): Similarities and Differences – What Progress Has Been Made since 2005?

Kommentar zu den Reanimationsrichtlinien 2010 für Neugeborene (AHA, ERC und ILCOR)

Authors: C. C. Roehr[1], G. Hansmann[2], T. Hoehn[3], C. Bührer[1]

Affiliations: [1] Department of Neonatology, Charité University Medical Center, Berlin, Germany
[2] Department of Cardiology, Children's Hospital Boston, Harvard Medical School, Boston, USA
[3] Department of General Paediatrics, University Medical Center, Düsseldorf, Germany

New cardiopulmonary resuscitation guidelines 2010: Managing the newly born in delivery room

Paolo Biban[a,*], Boris Filipovic-Grcic[b], Dominique Biarent[c], Paolo Manzoni[d]

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ELSEVIER DOYMA

ANALES DE PEDIATRÍA

www.elsevier.es/anpediatr

ARTÍCULO ESPECIAL

Adaptación de las recomendaciones internacionales sobre reanimación neonatal 2010: comentarios

M. Iriondo[a,*], E. Szyld[b], M. Vento[c], E. Burón[d], E. Salguero[e], J. Aguayo[f], C. Ruiz[g], D. Elorza[h] y M. Thió[i], Grupo de reanimación neonatal de la Sociedad Española de Neonatología[◊]

Filling gaps in the present ILCOR algorithm

Litterature

Perlman J, Kattwinkel J, Wyllie J, Guinsburg R, Velaphi S, Singhal N et al:
Neonatal Resuscitation: in Pursuit of Evidence Gaps in Knowledge
Resuscitation, 2012;83:545-550

Saugstad OD:
New Guidelines for newborn Resuscitation – a Critical Evaluation
Acta Paediatr, 2011;100:1058-62

Roehr CC, Hansmann G, Hoehn T, Bührer C:
The 2010 Guidelines on Neonatal Resuscitation (AHA, ERC, ILCOR; Similarities and differences – what progress has been made since 2005?
Klin Pädiatr 2011; 223:299-307

Biban P, Filipovic-Gric, Biarent D, Manzoni P:
New cardiopulmonary guidelines 2010: managing the newly born in the delivery room
Early Human Dev 2011;875:S9-S11

Iriondo M, Szyld E, Vento M, Buron E, Salguero E, Aguayo J, Ruiz C, Elorza D, Thio M:
Adaptacion de las recomendaciones internacionales sobre reanimacion 2010: Comentarios
Anales de Pediatria (Barcl) 2011;75:203:e1-e14

Filling gaps in the 2010 ILCOR algorithm

- **Indications for resuscitation**

  Heart rate
- **Stabilization Vs. Resuscitation**
- **Heart rate response**
- **Ventilation**

  PEEP, CPAP, Sustained inflation, ventilation techniques, establishing FRC
- **Suctioning**

  When to suction, endotracheal suctioning in not vigorous infants delivered through meconium stained amniotic fluid.
- **Medications, volume**

  adrenaline indication and dose
- **Chest compressions:ventilation ratio**
- **Oxygen supplementation**

  full term, late preterm, preterm, chest compressions/bradycardia
- ***p*CO_2**

  optimal level, monitoring
- **Effect of hypothermia following air resuscitation**
- **Temperature control**

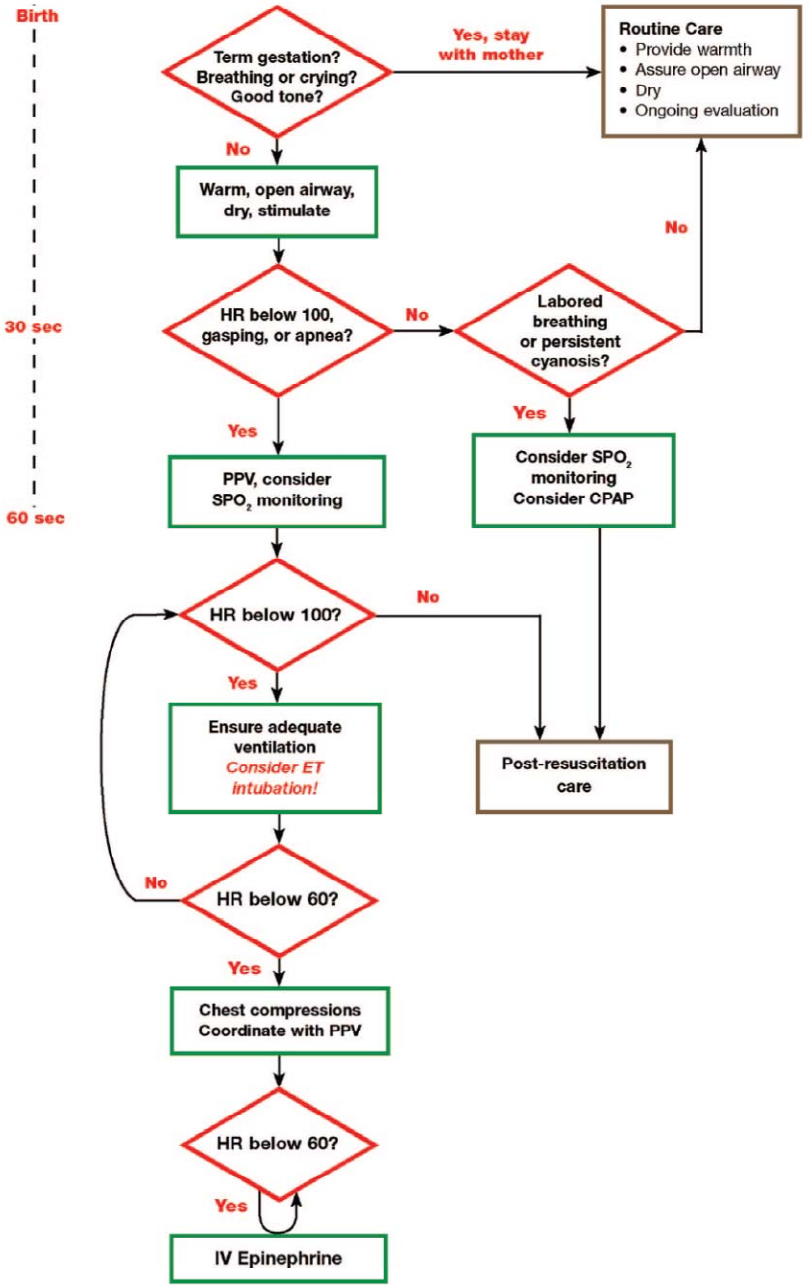
  maintenance of body temperature, maternal fever
- **Delayed cord clamping**
- **Guidelines for ELGAN/SGA**
- **Discontinuing resuscitation**
- **Education**
- **A new Apgar score?**

Indications for resuscitation

ILCOR Neonatal Resuscitation Guidelines 2010

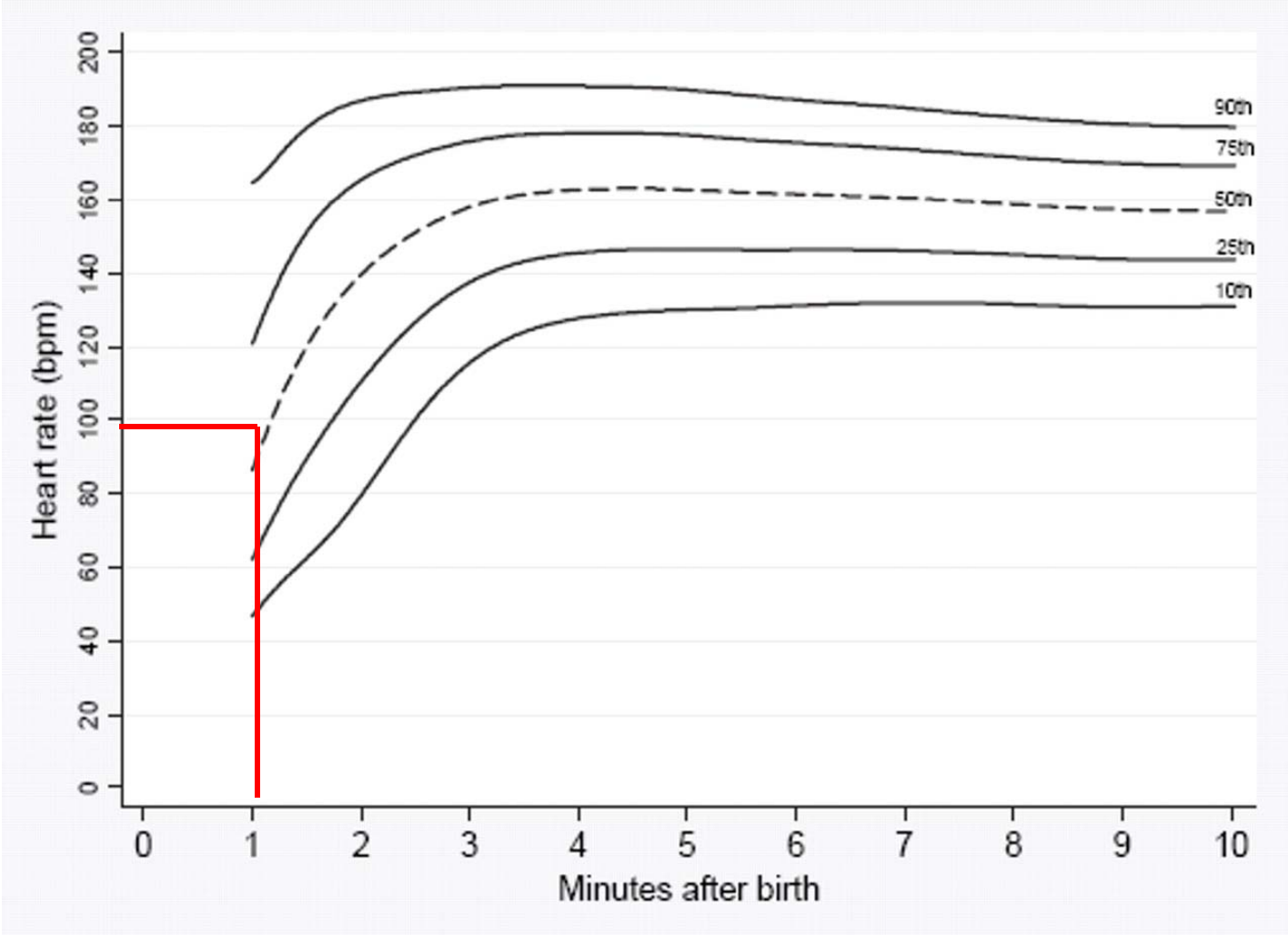
Indications for starting ventilation:
Heart rate < 100 bpm
and or apnea/insufficient breathing

Why heart rate < 100 bpm as an indication?



Perlman J et al, Circulation 2010;122 (Suppl 2) S

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

50 percentile for heart rate is 99 bpm at one min

Response to ventilation
chest rise or heart rate rise?

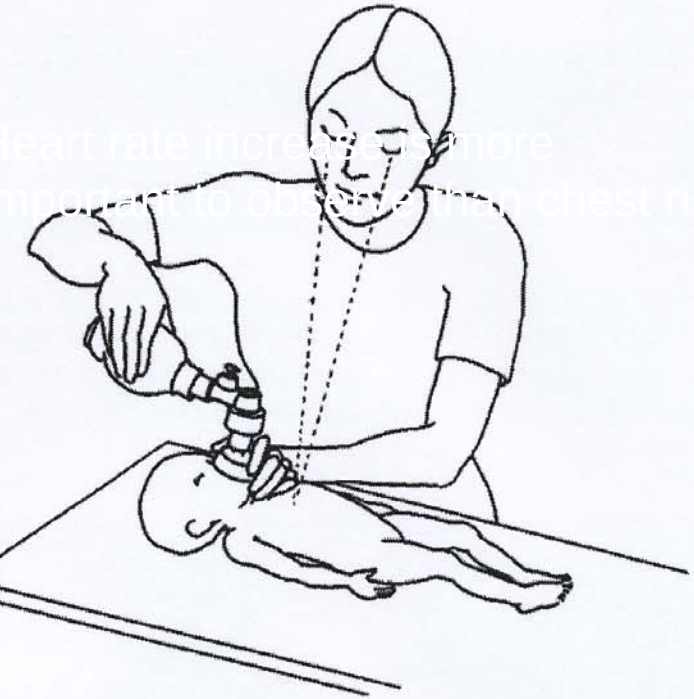


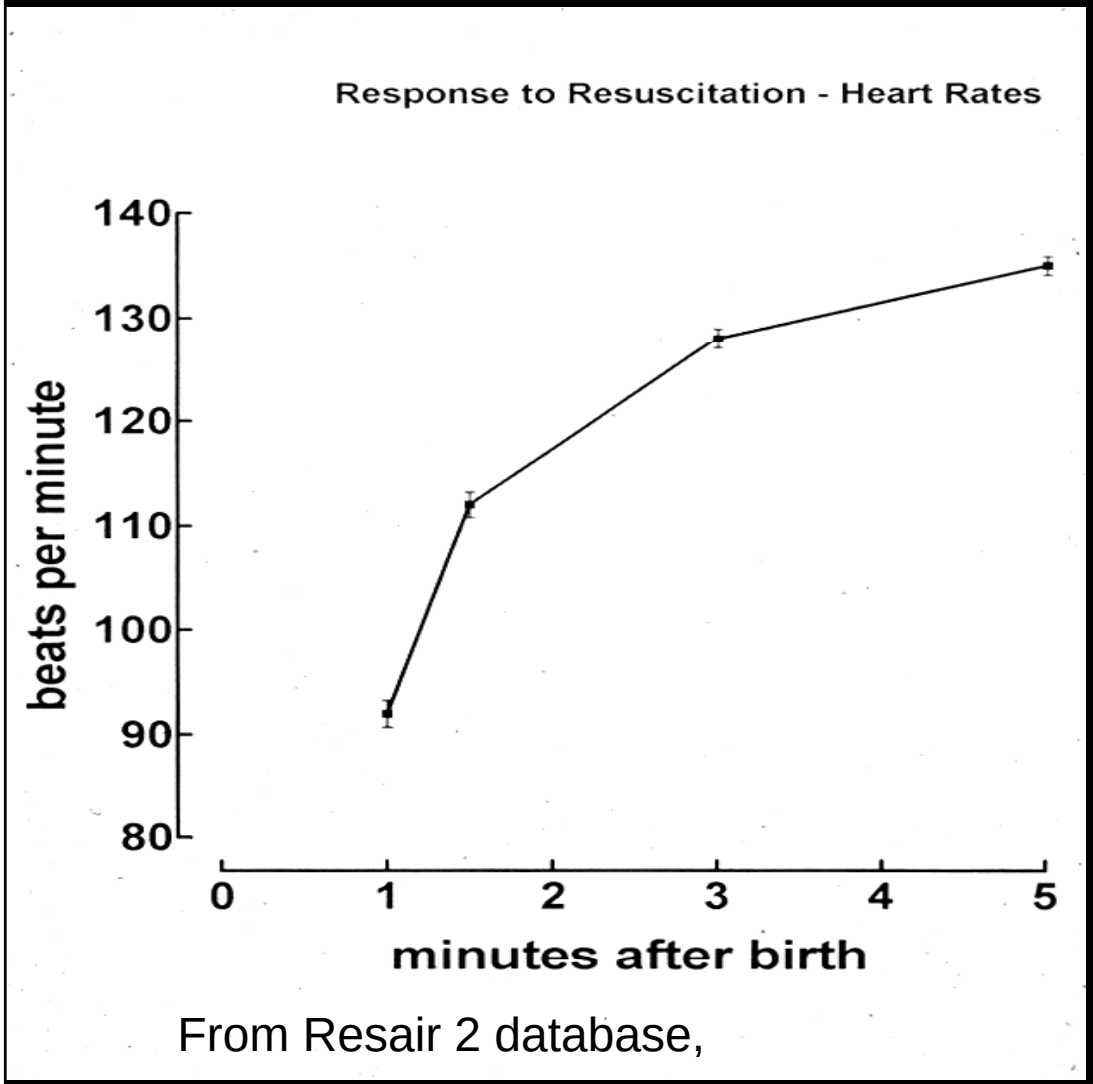
Figure 5: *Ventilation with bag and mask*

Heart rate increases more important to observe than chest rise

Figure 5: *Ventilation with bag and mask*

Basic Newborn Resuscitation, WHO 1998

Adequate Heart Rate Response



From Resair 2 database,

Increasing heart rate is the primary sign of effective ventilation during resuscitation

What is an adequate heart rate response?

20 bpm the first 30 seconds of ventilation

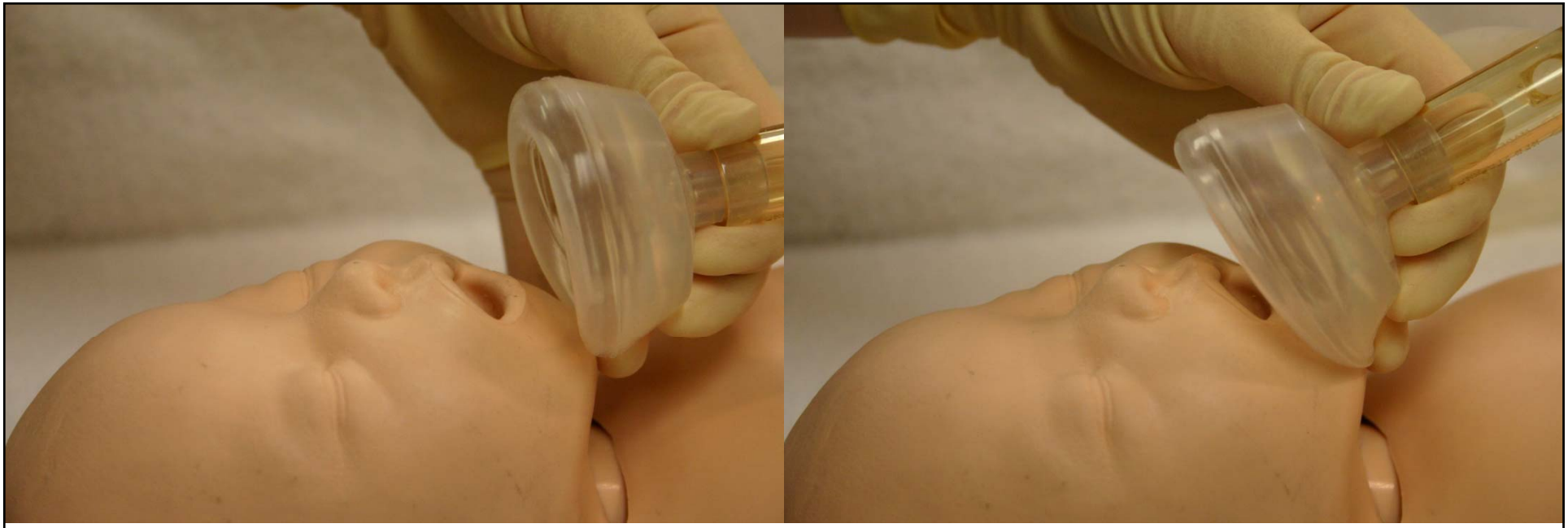
When to clamp the cord?

Wait to the first breath?

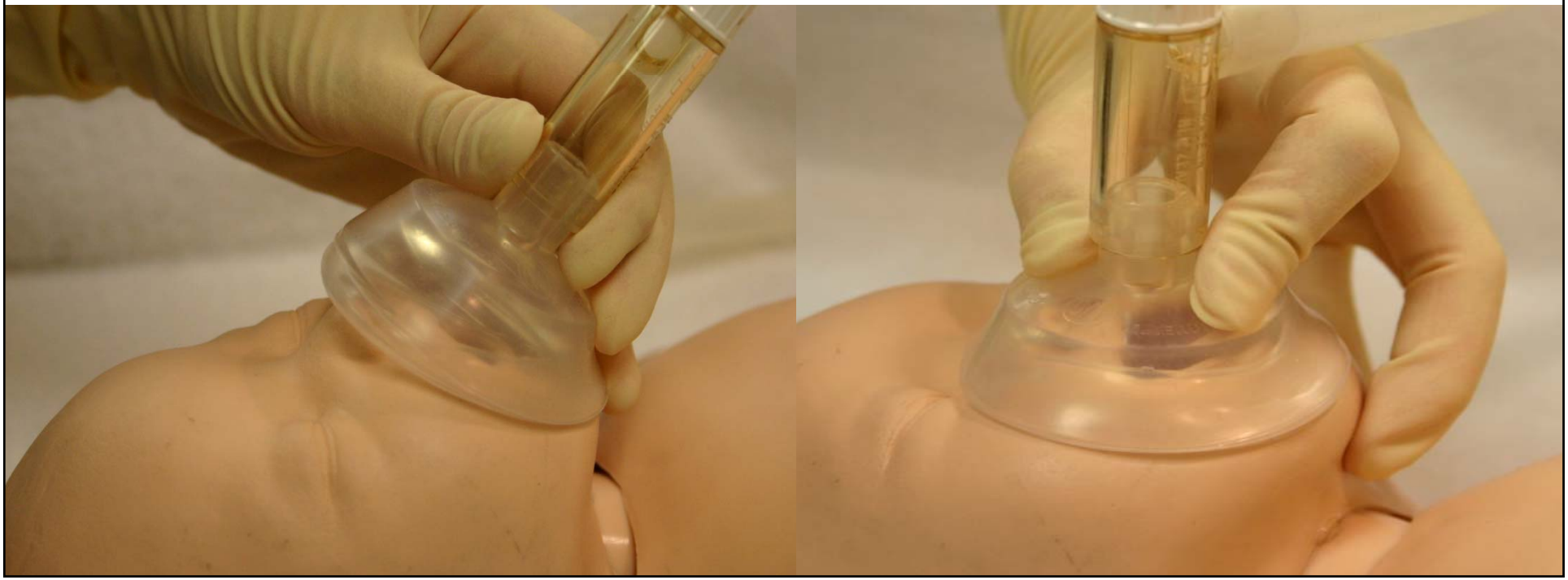
B. Ventilation

Mask ventilation is difficult

- mask leak
- obstruction
- low tidal volumes
- inconsistent tidal volumes
- delay in resuscitation



Rolling from chin tip, two point top hold, chin lift



Establishing FRC and delivery of breaths

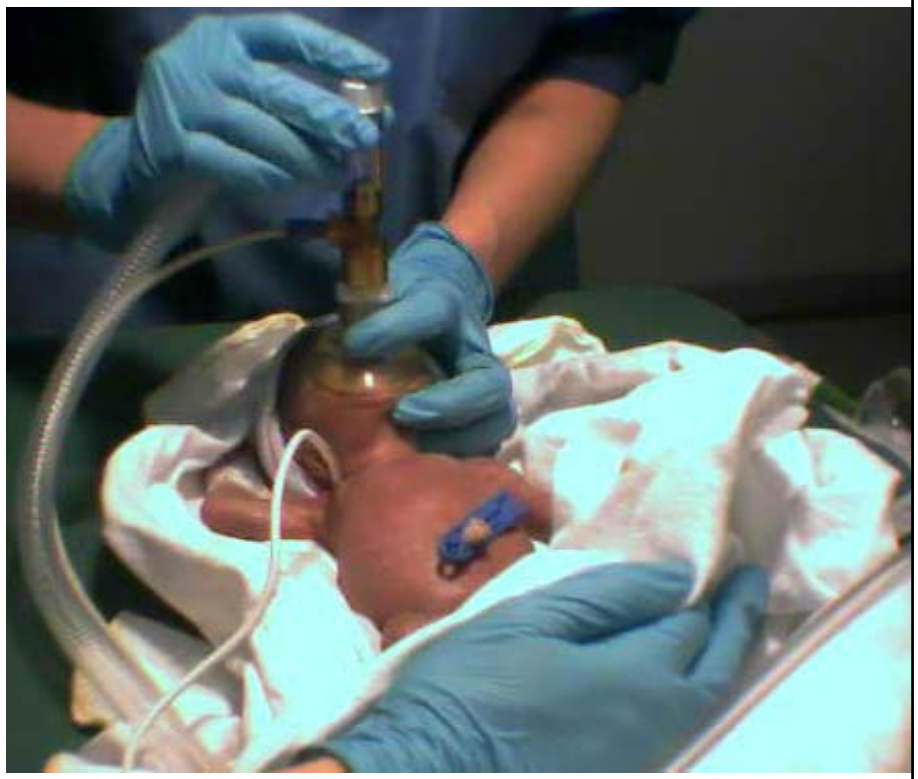
- Prolonged inspiratory time ?
- PPV with PEEP ?
- Should volume and pressure be measured during face mask ventilation, and what is the optimal volume to deliver?

Airway obstruction and gas leak during mask ventilation of preterm infants in the delivery room

Georg M Schmölzer,[1–4] Jennifer A Dawson,[1,3,5] C Omar F Kamlin,[1]
Colm PF O'Donnell,[6] Colin J Morley,[1,3] Peter G Davis[1,3,5]

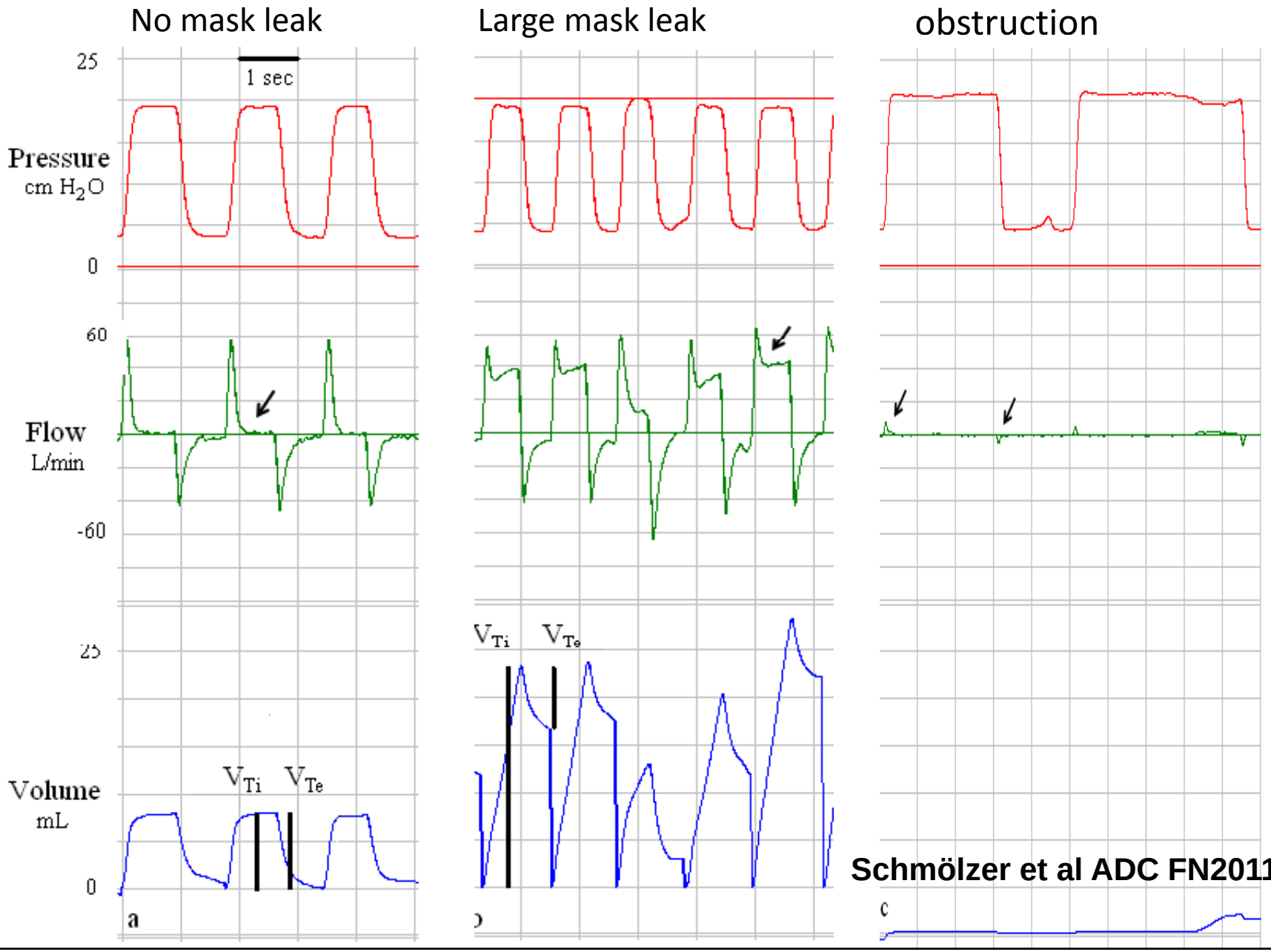
56 infants (< 32 weeks GA) needing mask ventilation at birth (T-piece and laerdal):

- In 70% of infants large leak (> 75%) at start
- obstruction: 25 %



Arch Dis Child FN 2011

Effectiveness of mask ventilation in preterm infants at birth



Schmölzer et al ADC FN2011

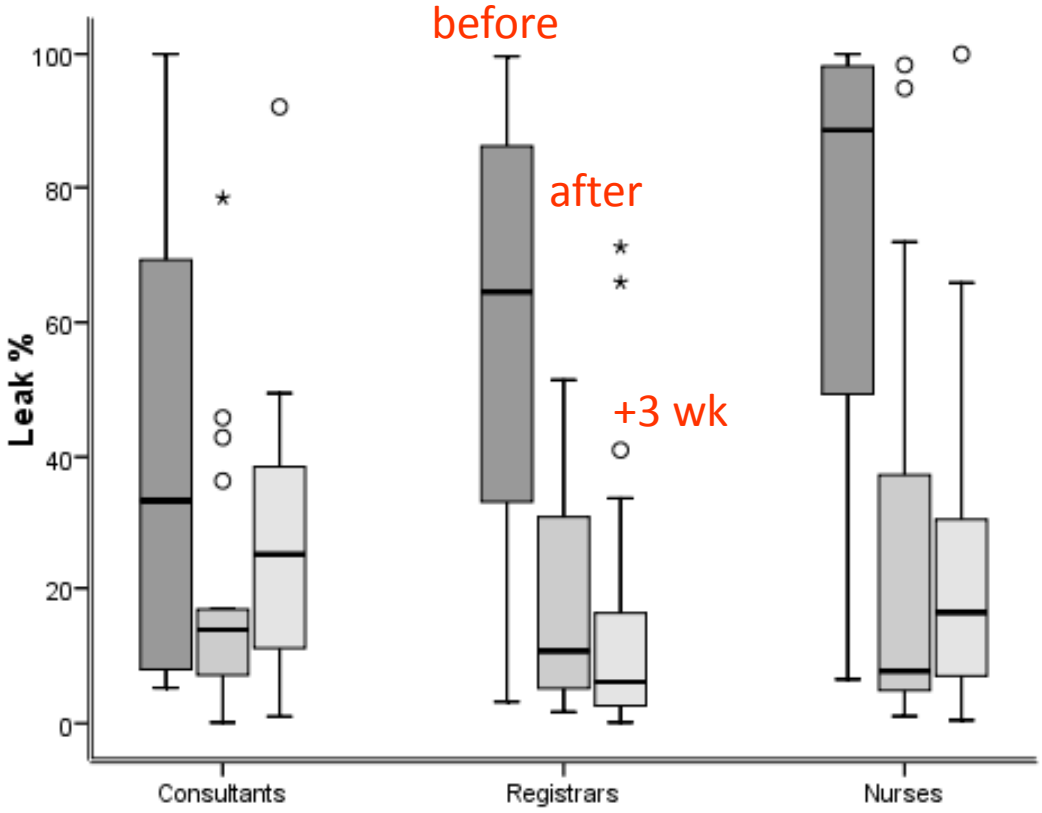
Improving mask ventilation

- improve technique: training
- improve device/interface

Training helps

Leak and obstruction with mask ventilation during simulated neonatal resuscitation

Kim Schilleman, Ruben S Witlox, Enrico Lopriore, Colin J Morley, Frans J Walther, Arjan B te Pas



Arch Dis Child Fetal Neonatal Ed 2010;**95**:F398–F402.

C. Circulation

Chest compressions - indication

Chest compressions should be performed if the heart rate is < 60 beats/minute, despite adequate ventilation

start with a 3:1 ratio - that is 90:30 events

Need:

0.8 per 1000 term or near term infants

2-10% in preterm infants

No human data have identified an optimal compression to ventilation ratio for cardiopulmonary resuscitation in any age

Goals: Reperfuse the heart (obtain diastolic pressure) and brain

Wyckoff et al, Pediatrics 2005:115:950-955
Finer et al Pediatrics 1999;104:428-34
Wyckoff and Berg Seminars Fetal and Neonatal Med 2008;13:410-415

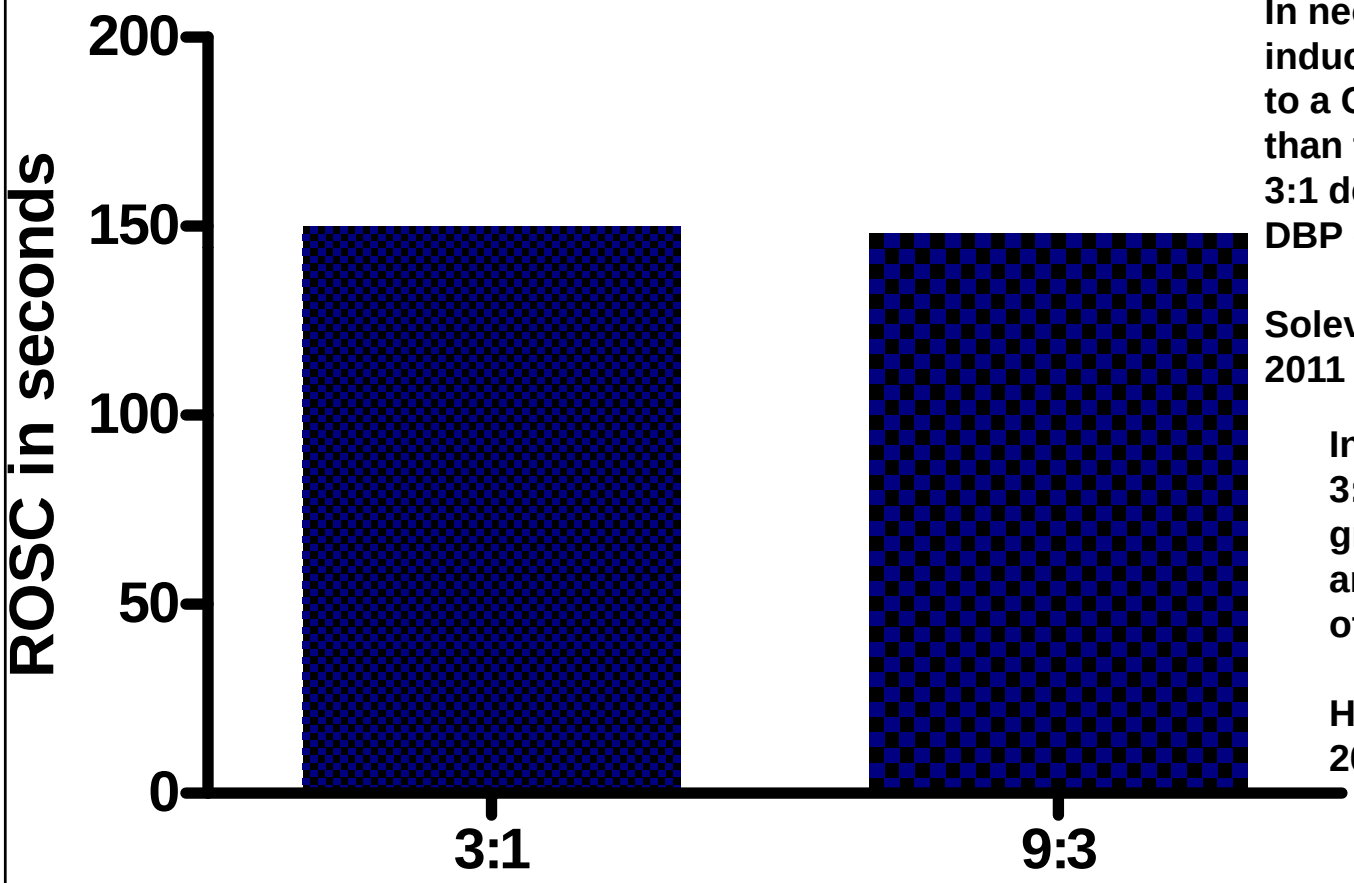
The two-thumb technique is superior to the two-finger method for administering chest compressions in a manikin model of neonatal resuscitation

	Two-thumb 3:1 (2 min)	Two-finger 3:1 (2 min)	p Value
Depth (mm)	29.0±5.4	23.7±5.8	0.0009
Variability (COV)	6.1±2.9	9.8±3.1	0.00002

C Christman, RJ Hemway, MH Wyckoff,JM Perlman Arch Dis Childhood 2010

What is optimal C:V ratio?

Time to return of spontaneous circulation after cardiac arrest



In neonatal pigs with asphyxia-induced cardiac arrest, the response to a C:V ratio of 15:2 is not better than the response to a C:V ratio of 3:1 despite better generation of DBP during resuscitation.

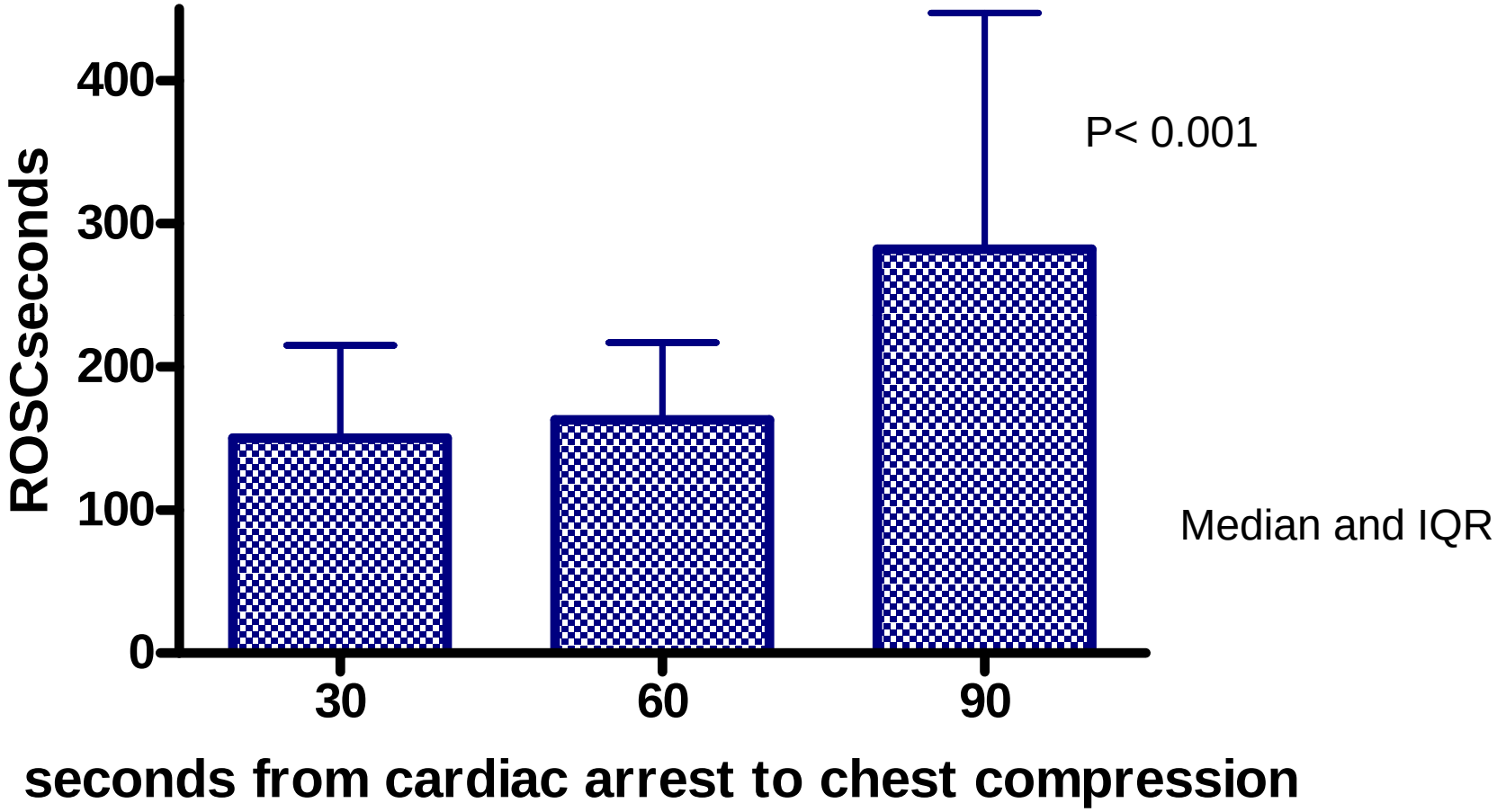
Solevaag et al ADC Fetal-Neonatal 2011 96:F417-F421

In a newborn manikin model 3:1 vs 15:2 ratio achieve greater depth of compression and more consistent depth of compressions over time

Hemway et al ADC Fetal-Neonatal 2012 April

Solevaag A et al Neonatology. 2011;99(2):153-62

Return of Spontaneous Circulation after Cardiac Arrest



Solvaag A et al, Resuscitation. 2010 Nov;81(11):1571-6

D. Drugs

Adenaline/Epinephrine dose

If adequate ventilation and chest compressions have failed to increase heart rate to > 60 bpm, then it is reasonable to use adrenaline despite the lack of human neonatal data.

Adrenaline for newborn resuscitation

- 6:10 000 newborns
- 0.1-0.3 mL/kg 1:10 000 adrenaline solution
- 1st dose at earliest at 4-5 min of life
- IV recommended

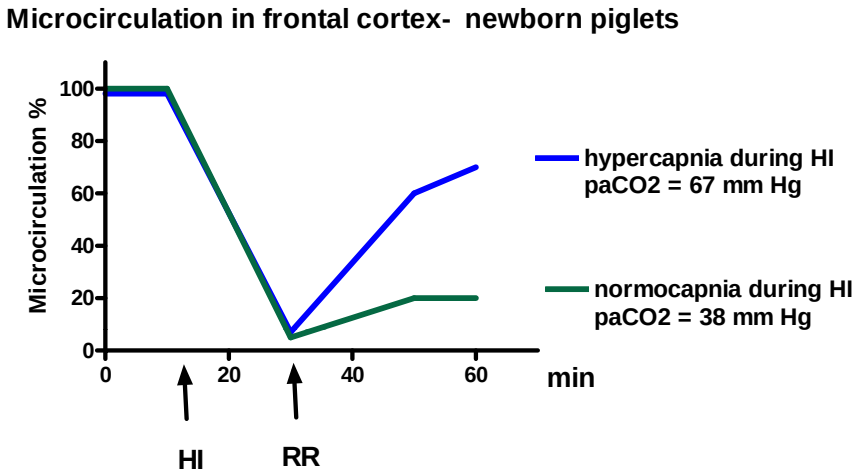
Barber et al Pediatrics 2006;118:1028-1034

However optimal dose has not been tested systematically

Does newborn children really need adrenaline for resuscitation?

What about pCO_2 ?

- pCO_2 is high in asphyxia
- Hypercapnia restores cerebral circulation faster than normocapnia
- Hypocapnia increases risk of brain injury
- Perhaps we need to be more careful in the DR ventilating even term babies?
- What is the optimal pCO_2 ?
- Routine monitoring of pCO_2 would be beneficial



Solås et al Ped Crit Care Med 2001;2:340
Solås et al Biol Neonate 2004;85:105

Virginia Apgar

Do we need a new Apgar Score

	0	1	2
Heart rate	0	<100	≥100
Respiration	0	Weak, irregular	Good cry
Reaction*	0	Slight	Good
Colour	Blue or pale	All pink, limbs blue	Body pink
Tone	Limp	Some movement	Active movements limbs well flexed

* Reaction to suctioning

Newborn Resuscitation

Current challenges

- **Optimal heart rate response not established**
- **Ventilation:chest compession ratio not established**
- **Sustained inflation?**
- **Optimal PEEP not established**
- **Optimal FiO_2 for chest compressions and preterms not established**
- **Optimal pCO_2 not established**
- **Optimal adrenaline dose not established**
- **Procedures for ELGAN/SGA not established**
- **Delayed clamping if need of resuscitation**
- **A new Apgar score?**

What about the future?

Just Follow the Road ....

Wisconsin USA

Thank you for your attention!

Comments – Questions?