Newborn Resuscitation

Filling the gaps - filling the gasps

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Interventions in term or near term newborn in the delivery room

**NUMBER**

136 mill

136 mill

4-6 mill

**INTERVENTION**

Assess baby’s response to birth

Keep baby warm
Position, (clear airway), stimulate to breathe by drying

Establish effective ventilation
- bag & mask ventilation
  
  Start with air

**FREQUENCY**

All

All

3 – 5/100

1/100-1/700

< 1/1000

0.6/1000

1/12000

**NUMBER**

1-2 mill

1 mill

1 mill

0.1 mill

**INTERVENTION**

- Endotracheal intubation

- Provide chest compressions

- Adrenaline

- Volume expansion

**FREQUENCY**

1/100-1/700

< 1/1000

0.6/1000

1/12000
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
New guidelines for newborn resuscitation – a critical evaluation

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Department of Paediatric Research, Oslo University Hospital, University of Oslo, Oslo, Norway

The 2010 Guidelines on Neonatal Resuscitation (AHA, ERC, ILCOR): Similarities and Differences – What Progress Has Been Made since 2005?
Kommentar zu den Keanimationsrichtlinien 2010 für Neugeborene (AHA, ERC und ILCOR)

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

Paolo Biban, Boris Filipovic-Gric, Dominique Biarent, Paolo Marzoni

* Neonatal and Paediatric Intensive Care Unit, Major City Hospital, Verona, Italy
Filling gaps in the present ILCOR algorithm

Litterature

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 Pediatría (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
- $pCO_2$
  - 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

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


50 percentile for heart rate is 99 bpm at one min
Response to ventilation
chest rise or heart rate rise?

Heart rate increase is more important to observe than chest rise.

Figure 5: Ventilation with bag and mask

Basic Newborn Resuscitation, WHO 1998
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.

From Resair 2 database,
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 Schmolzer,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 Davis1,3,5

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

No mask leak

Large mask leak

obstruction

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

before

after

+3 wk

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

<table>
<thead>
<tr>
<th></th>
<th>Two-thumb 3:1 (2 min)</th>
<th>Two-finger 3:1 (2 min)</th>
<th>p Value</th>
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<tbody>
<tr>
<td>Depth (mm)</td>
<td>29.0±5.4</td>
<td>23.7±5.8</td>
<td>0.0009</td>
</tr>
<tr>
<td>Variability (COV)</td>
<td>6.1±2.9</td>
<td>9.8±3.1</td>
<td>0.00002</td>
</tr>
</tbody>
</table>

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

Chest compressions:ventilation

Return of Spontaneous Circulation after Cardiac Arrest

D. Drugs
Adrenaline/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 pCO₂?

- pCO₂ 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 pCO₂?
- Routine monitoring of pCO₂ would be beneficial
Do we need a new Apgar Score

<table>
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<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>Heart rate</td>
<td>0</td>
<td>&lt;100</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Respiration</td>
<td>0</td>
<td>Weak, irregular</td>
<td>Good cry</td>
</tr>
<tr>
<td>Reaction*</td>
<td>0</td>
<td>Slight</td>
<td>Good</td>
</tr>
<tr>
<td>Colour</td>
<td>Blue or pale</td>
<td>All pink, limbs blue</td>
<td>Body pink</td>
</tr>
<tr>
<td>Tone</td>
<td>Limp</td>
<td>Some movement</td>
<td>Active movements</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>limbs well flexed</td>
</tr>
</tbody>
</table>

* Reaction to suctioning
Newborn Resuscitation

Current challenges

- Optimal heart rate response not established
- Ventilation: chest compression ratio not established
- Sustained inflation?
- Optimal PEEP not established
- Optimal FiO₂ for chest compressions and preterms not established
- Optimal pCO₂ 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 ....
Thank you for your attention!

Comments – Questions?