What’s New in Neonatal Resuscitation Guidelines?

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PSANZ representative, Australian Resuscitation Council
ANZCOR representative, International Liaison Committee on Resuscitation

Exceptional People. Exceptional Care.
Neonatal Resuscitation

“…is a common and important intervention. It is also a stressful and sometimes chaotic experience”.


- Difficult airways, vascular access
- Rapidly changing physiology
- Unique vulnerabilities
- Lifelong consequences
- Complex task
- Needs high reliability teams
## ARC Neonatal Resuscitation Guidelines

<table>
<thead>
<tr>
<th></th>
<th>2006 ARC</th>
<th>2010 ARC/NZRC</th>
<th>2016 ANZCOR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basis</strong></td>
<td>ILCOR 2005 CoSTR</td>
<td>ILCOR 2010 CoSTR</td>
<td>ILCOR 2015</td>
</tr>
</tbody>
</table>
| **Consultation** | “Australian neonatologists and others” | • PSANZ  
• member organisations of ARC & NZRC  
• Public | • PSANZ  
• member organisations of ARC & NZRC  
• Public |
| **Other** | Levels of Evidence and Strengths of Recommendation added | LOE and SR according to GRADE |
# Levels of Evidence

<table>
<thead>
<tr>
<th>Previous system</th>
<th>GRADE</th>
<th>Quality of evidence</th>
<th>Lower if</th>
<th>Higher if</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>Systematic review of all relevant RCTs</td>
<td><strong>High</strong></td>
<td>Risk of bias</td>
<td>Large effect</td>
</tr>
<tr>
<td>Level II</td>
<td>At least one properly designed RCT</td>
<td><strong>Moderate</strong></td>
<td>Inconsistency</td>
<td>Dose response</td>
</tr>
<tr>
<td>Level III-1</td>
<td>Pseudo-randomised trials</td>
<td>Low</td>
<td>Indirectness</td>
<td>All plausible confounding</td>
</tr>
<tr>
<td>Level III-2</td>
<td>Other comparative studies (cohort, case control, etc.)</td>
<td>Very low</td>
<td>Imprecision</td>
<td>+1 Would reduce a demonstrated effect or +1 Would suggest a spurious effect when results show no effect</td>
</tr>
<tr>
<td>Level IV</td>
<td>Comparative studies with historical control, single arm studies etc.</td>
<td></td>
<td>Publication bias</td>
<td></td>
</tr>
<tr>
<td>Level V</td>
<td>Case series</td>
<td></td>
<td></td>
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</tbody>
</table>

**GRADE**

Guyatt et al. J Clin Epi 2011

**Study design**

- Randomised trial
- Observational study
Parachutes reduce the risk of injury after gravitational challenge, but their effectiveness has not been proved with randomised controlled trials.
## ANZCOR Recommendations

<table>
<thead>
<tr>
<th>Previous system</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class A</strong></td>
<td><strong>Recommended</strong>&lt;br&gt;Guidelines are considered to be beneficial and should be used</td>
</tr>
<tr>
<td><strong>Class B</strong></td>
<td><strong>Acceptable</strong>&lt;br&gt;May be beneficial, are acceptable to use if appropriate in that setting</td>
</tr>
</tbody>
</table>
Newborn Life Support

At all stages ask: do you need help?

1 minute

Term gestation? Breathing or crying? Good tone?
- YES
  - Stay with Mother
  - Maintain normal temperature
  - Ensure open airway, Stimulate

- NO
  - Maintain normal temperature
  - Ensure open airway, Stimulate

HR below 100? Gasping or apnoea?
- YES
  - Positive pressure ventilation
  - SpO₂ monitoring
- NO

HR below 100?
- YES
  - Ensure open airway
  - Reduce leaks
  - Consider: Increase pressure & oxygen
  - Intubation or laryngeal mask
- NO

HR below 60?
- YES
  - Three chest compressions to each breath
  - 100% oxygen
  - Intubation or laryngeal mask
  - Venous access
- NO

IV Adrenaline 1:10,000 solution

<table>
<thead>
<tr>
<th>Gestation (weeks)</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-26</td>
<td>0.1 mL</td>
</tr>
<tr>
<td>27-37</td>
<td>0.25 mL</td>
</tr>
<tr>
<td>38-43</td>
<td>0.5 mL</td>
</tr>
<tr>
<td>10-30 mcg/kg (0.1-0.3 mL/kg)</td>
<td></td>
</tr>
</tbody>
</table>

Targeted pre-ductal SpO₂ after birth

- 1 min: 60-70%
- 2 min: 65-85%
- 3 min: 70-90%
- 4 min: 75-90%
- 5 min: 80-90%
- 10 min: 85-90%

Post-resuscitation care

Laboured breathing or persistent cyanosis?
- YES
  - Ensure open airway
  - SpO₂ monitoring
  - Consider CPAP
- NO

Maintain normal temperature, Ongoing evaluation

At all stages ask: do you need help?
Guideline 13.2
Planning, identification of newborn at risk

- Recommendation for annual training or refresher courses (previously recommended every 2nd year)
- Simulation is a useful training tool

2016: ANZCOR suggests that training of resuscitation instructors should incorporate timely, objective, structured, individually targeted, verbal and/or written feedback. (CoSTR 2015, weak recommendation, low quality evidence).

Training requires regular reinforcement in clinical practice, and/or refresher courses. We suggest that training should occur more frequently than annually. This retraining may consist of specific tasks and/or behavioural skills depending on the needs of the trainee. (CoSTR 2015, weak recommendation, low quality evidence).

Briefings and debriefings during learning activities while caring for simulated patients, and during clinical activities may also be helpful in improving individual and team skills.
Baby J – 27 weeks

• Not comatose
• Not pulseless
• May be trying to breathe
• Needs help to adapt to extrauterine life and survive

• How can we help him to help us to help him?
• How should we assess his need for resuscitation and monitor his condition and response?
• What should we do if he’s not breathing well?
• Uncomplicated term birth \([LOE I]\)
  – delay clamping for minimum of 1 min or until cessation of cord pulsation

2016: We suggest delayed umbilical cord clamping for preterm infants not requiring immediate resuscitation after birth. (CoSTR 2015, weak recommendation, very low quality of evidence)

• Compromised infant
  – optimal timing unknown & resuscitation measures may need to take priority \([Class B, Expert consensus opinion]\)
Temperature management – Guideline 13.1

Temperature management for <28 week babies
- Ambient temp of at least 26°C
- Polyethylene bag or wrap, without drying or unwrapping

• For all babies
  - Prevention of hyperthermia

• For 36+ weeks, at risk for HIE
  - Early consideration of induced hypothermia

2016: Admission temperatures to newborn units are predictors of outcome and should be recorded as a quality of care measure. (CoSTR 2015, strong recommendation, moderate quality of evidence) Hypothermia is associated with an increased risk of mortality. There is evidence of a dose effect with mortality increasing by 28% for each degree below 36.5°C at admission.
Guideline 13.3
Assessment of the Newborn Infant

- Initial assessment
  - tone
  - breathing
  - heart rate

- Subsequent assessment based on
  - tone
  - breathing
  - heart rate (most reliably assessed by ECG)
  - oxygenation - preferably assessed using pulse oximetry

Prompt increase in HR remains the most sensitive indicator of resuscitation efficacy
Assessment of Colour – eyeball vs oximetry

“The mean \( \text{SpO}_2 \) when infants were perceived to be pink by all 27 observers was 69% ranging from 10% to 100% between observers. The median \( \text{SpO}_2 \) for individual babies varied from 42% to 93%”
Guideline 13.3
Assessment of the Newborn Infant

Oximetry

• Recommended early and often!
• Continuous display of the heart rate within about a minute of birth
• Heart rate should be checked intermittently by auscultation
• Can play an important role in avoiding hyperoxaemia
2016:

- ANZCOR suggests that ECG monitoring can also be used to more rapidly and accurately display heart rate in the first 3 minutes of life (CoSTR 2015, weak recommendation; very low quality of evidence).

- Has the potential to reduce inappropriate interventions that might be implemented based on falsely low estimates of heart rates as assessed by pulse oximetry or auscultation.

- However ..... as yet no evidence whether outcomes are improved by early initiation of ECG monitoring.
Guideline 13.4

Airway Management & Mask Ventilation

- Normal newborn infants do not require suctioning of the nose, mouth or pharynx after birth (increased emphasis)

- Suctioning can delay the normal rise in oxygenation

- Suction recommended only
  - when babies show obvious signs of obstruction
  - to visualise the vocal cords during intubation
Guideline 13.4
Airway Management & Mask Ventilation

Initiating ventilation;

• aim is initially to establish functional residual capacity

• optimal strategy - not established

• sustained initial breaths and PEEP may be helpful, esp. in premature lungs
Effectiveness of T Piece Devices Versus Self-Inflating Bags

2016:
ANZCOR suggests the use of a T piece device for delivery of IPPV or CPAP during newborn resuscitation. In making this suggestion, we have diverged from the CoSTR Treatment Recommendation, which found insufficient evidence to recommend T piece resuscitators over self-inflating bags.

In doing so, we take into account the level of resources for health care in Australia and New Zealand and
• we place higher value on
  – benefits of PEEP in recruiting lung volume,
  – the routine use of manometry to adjust inflating pressures and
  – the reliable titration of oxygen concentration
• than on the lack of evidence from any large RCT showing improvement in outcome.
Guideline 13.4
Airway Management & Mask Ventilation

• Initial lung inflation in apnoeic newborn infants established with
  – IPPV with or without several initial prolonged inflation breaths
  – Insufficient evidence to recommend a particular approach

• Suggested initial pressure settings
  – Term infant       PIP 30 cm H₂O   PEEP 5 cm H₂O [Class B, LOE IV]
  – Preterm infant   PIP 25 cm H₂O   PEEP 5 cm H₂O [Class B, LOE III-3]
  – suggested Maximum Pressure Relief 50 cm H₂O

• Pressures adjusted according to response
  
  *For most infants, ventilation can be accomplished with progressively lower pressures and rates as resuscitation proceeds*
Guideline 13.4
Airway Management & Mask Ventilation

Role of Supplemental Oxygen

• Blood oxygen levels of normal newborns can take up to 10 minutes to rise above 90%

• Increasing evidence that even brief exposure to excessive oxygenation can be harmful

• Term infants resuscitated in 100% oxygen vs room air
  – Worse survival
  – Increased time to first breath or cry
  – Markers of oxidative injury increased

• Preterm infants
  – 100% oxygen more likely to result in hyperoxaemia
  – More chronic lung disease
Guideline 13.4
Airway Management & Mask Ventilation

Recommendations for oxygen

Term babies: commence resuscitation in room air [Class A, LOE I]

Preterm: commence in room air or blended air & O2 (30-50%)

*In all cases, the first priority is to ensure adequate inflation of the lungs, followed by increasing the concentration of inspired oxygen only if needed*

Adjust oxygen using pulse oximetry to meet targeted saturations

<table>
<thead>
<tr>
<th>Time from birth</th>
<th>Target saturations for newborn infants during resuscitation</th>
</tr>
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<tbody>
<tr>
<td>1 min</td>
<td>60-70</td>
</tr>
<tr>
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<td>5 min</td>
<td>80-90</td>
</tr>
<tr>
<td>10 min</td>
<td>85-90</td>
</tr>
</tbody>
</table>
Oxygen Saturations – normal & targets

Source of underlying graph: Dawson et al., Paediatrics 2010
Guideline 13.5

Tracheal Intubation & Ventilation

- Indications for intubation
  - unsuccessful or prolonged face mask ventilation
  - special circumstances (e.g. congenital diaphragmatic hernia, ELBW, abdominal wall defect or gut obstruction)
  - infants born without a detectable heartbeat

- Decision to intubate dependent on
  - gestation
  - degree of respiratory depression
  - response to face mask ventilation
  - skill and experience of the resuscitator
## Intubation during (video-recorded) neonatal resuscitation

<table>
<thead>
<tr>
<th>Success rate</th>
<th>Mean duration (sec) [range]</th>
<th>Recommended time limit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>41%</td>
<td>27.5 [8-48]</td>
<td>30 second limit</td>
<td>Lane 2004 San Diego</td>
</tr>
<tr>
<td>62%</td>
<td>31 [8-70]</td>
<td>No limit</td>
<td>O'Donnell 2006 Melbourne</td>
</tr>
<tr>
<td>48%</td>
<td>38 [21-77]</td>
<td>No limit</td>
<td>Nadler &amp; McLanders 2016 Brisbane</td>
</tr>
</tbody>
</table>

*Duration measured from ‘laryngoscope in’ to ‘laryngoscope out’*

Baby M – depressed at birth, meconium exposed

- Suctioning for meconium?
- What if he doesn’t breathe and heart rate is very slow?
Infants exposed to meconium stained fluid

- No evidence for oropharyngeal suction after delivery of head
- Airway suctioning of vigorous babies discouraged - likely to cause harm
- “Insufficient evidence to recommend a change in current practice of performing endotracheal suctioning of non-vigorous infants”
- If tracheal suction is performed, it must be accomplished before spontaneous or assisted respirations have commenced, very promptly, and once only
Guideline 13.4 cont’d

Airway Management & Mask Ventilation

2016 Infants exposed to meconium stained fluid

…..Taken together, ANZCOR suggests that there is insufficient published human evidence to suggest routine tracheal intubation for suctioning of meconium (CoSTR 2015).

Potential benefits of removing meconium …..need to be weighed against what is likely to be an urgent need for other resuscitation manoeuvres.

Emphasis should be made on initiating ventilation rapidly in non-breathing or ineffectively breathing infants.
Effective ventilation is the key to successful neonatal resuscitation
LARYNGEAL MASK
Guideline 13.6

Chest Compressions

• Indication
  – heart rate <60/min despite adequate assisted ventilation for 30 seconds (chest wall obviously moving with each inflation)

• Inflations and chest compressions
  • 3:1 ratio
  • 90 compressions per minute
  • half second pause after each 3rd compression to deliver a breath
  • compressions and inflations should be coordinated to avoid simultaneous delivery of a compression and a breath
Guideline 13.6 cont’d

Chest Compressions

- Two-thumb technique
  - improved peak systolic and coronary perfusion pressure
  - more consistent compressions over long periods of time
  - easier, less tiring

- Suggestion to change position to face baby’s feet to allow two-thumb technique
Guideline 13.6

Chest Compressions

• Avoid interruptions in continuity of chest compressions
  – chest compressions should be performed with as little interruption as possible, and for at least 30 seconds between each pause for assessment of heart rate and cardiac output
  – *Do not stop unless assessment is needed to make treatment decisions*

• *Compression site & depth, Cadence, Continuity*
Guideline 13.7

Medication & Fluids

• Intravascular - preferred route for administration of adrenaline
  – UVC
    • Usually most rapidly accessible intravascular route
  – Alternatives
    • Intraosseous
    • Peripheral venous
• ETT adrenaline
  – Can be given *while IV access is underway*
  – Should not delay administration of IV adrenaline

2016: *Increased emphasis that as soon as chest compressions are begun, insertion of intravascular line should begin*
**Guideline 13.7**

**Medication & Fluids**

- **Volume Expanding Fluids**
  - Evidence that routine fluid boluses may cause harm
  - Only recommended when there is evidence of, or strong suspicion of hypovolaemia

  *In these circumstances response to intravenous volume infusion is usually dramatic.*

  - Blood loss may be occult – a trial of volume may be considered if no response to resuscitation

**2016:** Consider the need for a Critical Bleeding protocol

Thanks!

Any attempt at resuscitation is better than no attempt