First Response
Learning Module 2
Based on ILCOR and ANZCOR 2016

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Learning objectives

Following completion of the theoretical & practical components of this module, the participant will be able to demonstrate their ability to:

- Assess a newborn infant’s transition to extra-uterine life & determine the need for resuscitation.
- Initiate **First Response** interventions including face mask ventilation and external chest compressions.
- Assess the newborn’s response to these interventions and determine when **Advanced Resuscitation** interventions are required.
Transition to extra-uterine life

- Very few newborns require “resuscitation”
- Most will respond to simple interventions
- First Response interventions are therefore most important & time critical

### Resuscitation at birth in Australia: 2012

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suctioning</td>
<td>5%</td>
</tr>
<tr>
<td>Oxygen therapy</td>
<td>5%</td>
</tr>
<tr>
<td>Positive pressure ventilation</td>
<td>5%</td>
</tr>
<tr>
<td>Intubation &amp; positive pressure ventilation</td>
<td>1%</td>
</tr>
<tr>
<td>Cardiac compressions &amp; positive pressure ventilation</td>
<td>0.3%</td>
</tr>
</tbody>
</table>
Preparation for resuscitation

- Anticipation of need
  - Based on risk assessment
- Equipment
  - Checked and ready for use
- Environment
  - Warm and clean
- Skilled personnel
  - Able to form a team, nominate leadership and develop a plan of action

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Cord clamping & cord milking

ILCOR and the ANZCOR suggest:

- Delayed cord clamping for 30-60 seconds if:
  - Uncomplicated term or preterm birth, and
  - Not requiring immediate resuscitation

For compromised newborns:

- Insufficient evidence for optimal timing of cord clamping in term and preterm depressed newborns

- Insufficient evidence of benefit of cord milking, especially if <28 weeks. Not recommended.
Monitoring

- Pulse oximetry is recommended:
  - When the need for resuscitation is anticipated
  - When CPAP or positive pressure is used
  - When persistent cyanosis is suspected
  - When supplemental oxygen is used
  - Place the oximeter sensor on the right wrist or hand (pre-ductal oxygen saturation)

- ECG monitoring:
  - May be used as an adjunct to auscultation and pulse oximetry (if readily available)
Strategies to maintain normal core temperature: 36.5 - 37.5°C

- Very preterm newborns (<32 weeks):
  - Place (wet & warm) into a polyethylene bag or under a polyethylene sheet
  - Radiant warmer

- Additional measures (alone or in combination):
  - Covering the head (except the face) with a hat/bedding
  - Ambient room temperature 23 - 26°C
  - Exothermic warming mattress
A: Assess and Airway

**Assessment**
Term gestation?
Breathing or crying?
Good tone?

**Actions**
Maintain normal temperature
Ensure open airway
Stimulate

**Assessment**
HR below 100/min?
Gasping or apnoea?

**Actions**
Positive pressure ventilation
Oxygen saturation (SpO₂) monitoring

**Assessment**
Laboured breathing or persistent cyanosis?

**Routine care:**
Prevent heat loss
Ongoing evaluation

At all stages ask: Do you need help?

1 minute
If meconium liquor is present

- Clear the oro-pharynx if obvious meconium

If the newborn is vigorous:
- Endotracheal suctioning is discouraged because it does not alter outcome and may cause harm

If the newborn is not vigorous:
- No evidence of the value of routine or repeated endotracheal suctioning to prevent meconium aspiration
- Likely to cause further delays in resuscitation
- Tracheal intubation for suctioning should only be performed for suspected tracheal obstruction.
B: Breathing

Assessment
Heart rate below 100/min?
Gasping or apnoeic?

→ YES

NO

Assessment
Laboured breathing or Persistent cyanosis

→ YES

Actions
Ensure open airway
SpO₂ monitoring
Consider CPAP

→ NO

Assessment
Heart rate below 100/min?

→ NO

NO

Actions
Ensure open airway
SpO₂ monitoring
Consider CPAP

→ YES

Post resuscitation care

* Endotracheal intubation may be considered at several stages

At all stages ask: Do you need help?
Manual ventilation devices

“A T-piece device, a self inflating bag and a flow inflating bag are all acceptable devices to ventilate newborn infants either via a face mask, laryngeal mask or endotracheal tube”. (ANZCOR, 2016)
Initial settings: T-piece device

- Gas flow
  - Set at 10 L/min (8 L/min if using cylinders)
- Maximum pressure relief valve
  - Set at 50 cm H₂O
- Peak inspiratory pressure (PIP)
  - Set at 30 cm H₂O (term newborn)
  - Set at 20 - 25 cm H₂O (preterm <32 weeks)
- Positive end expiratory pressure (PEEP)
  - Set at 5 - 8 cm H₂O

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PEEP during resuscitation

- Without PEEP:
  - Lung aeration is not achieved as quickly
  - Functional residual capacity (FRC) is not established

- With PEEP:
  - FRC is established and maintained
  - Oxygenation is improved

- ANZCOR (2016) recommend:
  - PEEP of 5 - 8 cm H₂O during resuscitation of newborn infants if appropriate equipment available
Oxygen use in resuscitation

- **Term and near term newborns**
  - Use room air (21%) initially.
  - Introduce supplemental oxygen if lower end of target saturations are not met, despite respiratory support.

- **Preterm newborns <35 weeks’ gestation**
  - Use room air (21%) or
  - Blended air and oxygen (up to 30%) to start
  - Avoid initiating resuscitation with high supplementary oxygen concentrations (65-100%)
  - If a blend of air and oxygen is not available, use air

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Oxygen use in resuscitation

- **All newborns**
  - Oxygen should be used judiciously, guided by pulse oximetry
  - Avoid hyperoxaemia
  - Avoid hypoxaemia

- **If external chest compressions are required:**
  - Increase oxygen concentration to 100%
  - Oxygen concentration should be weaned as soon as the heart rate has recovered and target saturations are being met.
Target saturations for newborn infants during resuscitation

<table>
<thead>
<tr>
<th>Time after birth in minutes</th>
<th>Targeted pre-ductal oxygen saturations for newborn infants during resuscitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>60 – 70%</td>
</tr>
<tr>
<td>2 minutes</td>
<td>65 – 85%</td>
</tr>
<tr>
<td>3 minutes</td>
<td>70 – 90%</td>
</tr>
<tr>
<td>4 minutes</td>
<td>75 – 90%</td>
</tr>
<tr>
<td>5 minutes</td>
<td>80 – 90%</td>
</tr>
<tr>
<td>10 minutes</td>
<td>85 – 90%</td>
</tr>
</tbody>
</table>

ANZCOR², 2016, Guideline 13.4
Positive pressure ventilation

Optimal positive pressure ventilation requires:

1. An appropriate sized face mask
2. A good seal between the mask and the face (to minimise leak)

Re-assess the heart rate every 30 seconds.
Ventilation rate and pressure

- Rate: 40 - 60 inflations per minute
- Peak inflating pressure (PIP):
  - Variable and should be individualised
  - Effective ventilation may be achieved with progressively lower pressures and rates
- Avoid hyperventilation (excessive PIP &/or rate)
  - Can lead to dangerously low CO₂ levels (<30 mmHg)
  - Can depress respiratory drive
  - Can reduce cerebral blood flow
Assessing the effectiveness of positive pressure ventilation

- Re-assess the heart rate every 30 seconds
- The effectiveness of ventilation is confirmed by:
  1. An increase in the heart rate above 100/min.
  2. A slight rise and fall of the chest and upper abdomen with each inflation.
  3. An improvement in oxygenation (assessed by pulse oximetry).
If the heart rate is not improving with positive pressure ventilation

- Check the ventilation technique
  - Is there a face mask leak?
  - Is the airway patent?

- Increase the peak inflating pressure
  - Increase the PIP in 5 cm increments:
    - 30→ 35→ 40→ 45→ 50+ cm H₂O if necessary

- Increase oxygen according to SpO₂ targets
  - Increase to 100% if the heart rate is <60/min
C: Circulation

Assessment
Heart rate below 60/min?

YES

Actions
Three chest compressions to each breath
100% oxygen
Intubation or laryngeal mask
Venous access

* Endotracheal intubation should be considered
+ Ensure the O₂ has been increased to 100% if the heart rate is <60/min

Assessment
Heart rate below 60/min?

YES

At all stages ask: Do you need help?

YES

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Techniques for ECC in newborns

Hand encircling, two thumb technique (preferred technique)  Two finger technique

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Advanced resuscitation interventions are indicated if first response interventions do not result in an improvement in:

- Heart rate
- Breathing
- Pre-ductal oxygen saturation (SpO₂)
- Muscle tone
Interventions include:

- Intubation
- Insertion of a laryngeal mask airway
- Establishing umbilical venous or intraosseous access
- Administration of adrenaline
- Administration of volume expanders
  - 0.9% sodium chloride
  - O-neg red blood cells if blood loss or shock

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Preparing for intubation

Select an appropriate size endotracheal tube according to estimated birth weight

Endotracheal size internal diameter can also be calculated as gestation age in weeks divided by 10

<table>
<thead>
<tr>
<th>Corrected gestation (Weeks)</th>
<th>ETT size (Guide: GA ÷ 10)</th>
<th>Actual weight (kg)</th>
<th>ETT mark at the lip (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 – 24</td>
<td>0.5 – 0.6</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>25 – 26</td>
<td>2.5 mm</td>
<td>0.7 – 0.8</td>
<td>6.0</td>
</tr>
<tr>
<td>27 – 29</td>
<td>0.9 – 1.0</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>30 – 32</td>
<td>3.0 mm</td>
<td>1.1 – 1.4</td>
<td>7.0</td>
</tr>
<tr>
<td>33 – 34</td>
<td>1.5 – 1.8</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>35 – 37</td>
<td>1.9 – 2.4</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>38 – 40</td>
<td>3.5 mm</td>
<td>2.5 – 3.1</td>
<td>8.5</td>
</tr>
<tr>
<td>41 - 43</td>
<td>3.2 – 4.2</td>
<td>9.0</td>
<td></td>
</tr>
</tbody>
</table>
Preparing adrenaline

- Use 1:10,000
- Intravenous route recommended - will require venous access (insertion of an umbilical venous catheter, peripheral intravenous cannula or intraosseous needle)

<table>
<thead>
<tr>
<th>Route</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umbilical vein</td>
<td>0.1 - 0.3 mL/kg (10 - 30 mcg/kg)</td>
</tr>
<tr>
<td>Peripheral IV</td>
<td></td>
</tr>
<tr>
<td>Intraosseous</td>
<td></td>
</tr>
<tr>
<td>Endotracheal tube (ETT)</td>
<td>0.5 - 1.0 mL/kg (50 - 100 mcg/kg)</td>
</tr>
</tbody>
</table>
D: Drugs

Assessment +
Heart rate below 60/min?

Actions *
IV Adrenaline: 1:10,000
Dose: 0.1-0.3 mL/kg
Consider volume expansion

* Endotracheal intubation should be performed
* Ensure the O₂ has been increased to 100% if the heart rate is <60/min

At all stages ask: Do you need help?

Remember to document all interventions & the newborn’s response

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For more information on:

- Intubation
- Use of an exhaled CO$_2$ detector
- Use of a laryngeal mask airway (LMA)
- Intravenous, umbilical and intraosseous access
- Medications
- Discontinuation &/or withdrawal of resuscitation
- Resuscitation in special circumstances
- Post resuscitation care and stabilisation

- See the “Learning Resources” section of the NeoResus web site at [http://www.neoresus.org.au](http://www.neoresus.org.au)
Section 13.1 – 13.10
Neonatal Guidelines
Published January 2016
Available for download at www.resus.org.au
Key references


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