neoResus
The Victorian Newborn Resuscitation Project

First Response

Learning Module 2

Learning objectives

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

- Set up, operate and troubleshoot the equipment used in First Response care of the newborn.
- 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.

The transition to extra-uterine life

- Very few newborn infants require "resuscitation" (ECC, drugs, intubation).
- Some newborns will need assistance to begin breathing at birth (~ 7% in Australia).
- Most newborns will respond to simple manoeuvres to help them start breathing.
- "First Response" interventions are therefore most important & time critical.

Resuscitation at birth

Of the 299,588 live births in Australia in 2011:

- 76% No intervention
- 7% Received suctioning
- 9% Received oxygen therapy
- 6.5% Received IPPV
- 0.8% Received intubation + IPPV
- 0.3% Received ECC + IPPV

(AIHW, 2013: *Australia's Mothers and Babies 2011*[1])

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

The First Response team

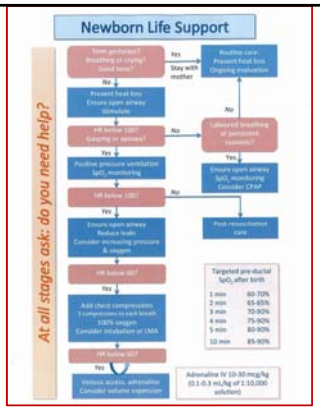
- At every birth at least one member of the team should have resuscitation skills.
- Members of the team need to know the role, expectations and skills of the other team members.
- Communication and cooperation between team members are essential.

Australian & New Zealand newborn resuscitation guidelines

Section 13.1 – 13.10
Neonatal Guidelines

Available for download at
www.resus.org.au

Published by the Australian Resuscitation Council (ARC) & the New Zealand Resuscitation Council [2] (NZRC) in December 2010

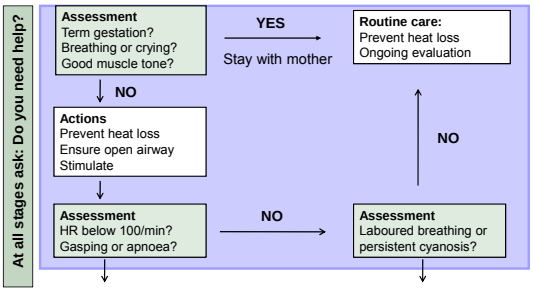


ARC & NZRC Newborn Life Support Flow Chart

Maintain warmth

- Aim to achieve normothermia (36.5 - 37.5ºC).
- Avoid iatrogenic hyperthermia in all newborns.
- Preterm newborns: <28 weeks or <1500 grams:
  - Birth in a room with an ambient temperature of ≥26ºC.
  - Immediately place, while still wet and warm, into a polyethylene wrap or (food or medical grade, heat resistant), enclosed up to the neck with the head out.
  - Dry the newborn's head and cover with a hat or a dry, warm towel or blanket.

A: Airway



If meconium liquor is present

If the newborn is vigorous:

- Only clear the mouth, followed by the nose, if the airway appears obstructed by meconium.
- Endotracheal suctioning is discouraged because it does not alter outcome and may cause harm.[13] (LOE 2)

If the newborn is not vigorous:

- Consider tracheal suctioning if a person with the expertise to perform endotracheal intubation is available.
- Otherwise, suction the oropharynx with a 10-12 Fg catheter, then assess the newborn's heart rate and breathing.

Management of meconium (cont.)

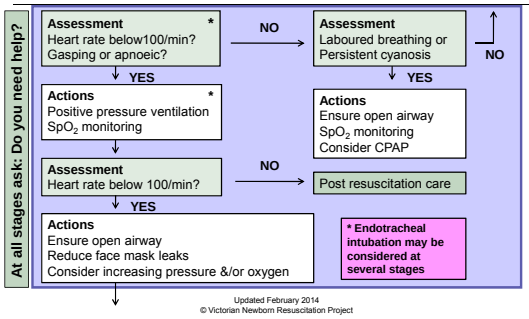
If tracheal suction is performed, it should be:

- Before the newborn is stimulated to breathe
- Prompt, to minimise delay in establishing breathing
- Before positive pressure ventilation is provided

"The potential benefit of removing meconium from the trachea needs to be weighed against what is likely to be an urgent need for other resuscitation manoeuvres."

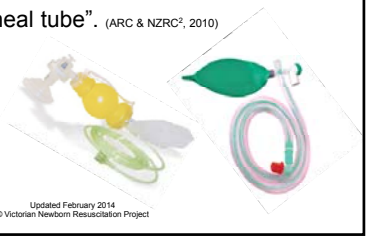
(ARC & NZRC[2], 2010, Guideline 13.4)

B: Breathing



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 or endotracheal tube". (ARC & NZRC[2], 2010)



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 H_2O
- Peak inspiratory pressure (PIP)
  - Set at 30 cm H_2O (term newborn)
  - Set at 20 - 25 cm H_2O (preterm <32 weeks)
- Positive end expiratory pressure (PEEP)
  - Set at 5 - 8 cm H_2O

PEEP during resuscitation

- With PEEP:
  - FRC is established and maintained
  - Oxygenation is improved
- Without PEEP:
  - Lung aeration is not achieved as quickly
  - Functional residual capacity (FRC) is not established
- The ARC & NZRC[2] (2010) recommend:
  - If suitable equipment is available, PEEP (at least 5 cm H_2O) should be used during resuscitation

Face mask leaks are common

- Leaks averaging 40 to 70% around face masks are common due to poor mask placement technique.[14]
- How you hold the face mask will determine how much leak you have and therefore how effectively you ventilate the newborn infant.
- The "two point top hold" is one method that has been shown to reduce face mask leak.

(Wood *et al.*, 2008[14])

Reducing leak using the "two point top hold" with a round mask

The stem hold | The two point top hold | The OK rim hold

Reference: Wood, *et al.* (2008). *Archives of Disease in Childhood, Fetal & Neonatal Edition, 93*, p. F 231.

Ventilation rate and pressure

- Ventilate at a rate of 40 - 60 inflations per minute.
- Peak inflating pressures required are variable and should be individualised.
- Be aware:
  - Hyperventilation (excessive PIP &/or rate) can lead to dangerously low CO_2 levels (<30 mmHg). This can further depress the infant's breathing centre & reduce cerebral blood flow.
  - Avoid hyperventilating newborns who are unlikely to have parenchymal lung disease.

Assessing the effectiveness of positive pressure ventilation

The effectiveness of ventilation is confirmed by:

- An increase in the heart rate above 100/min.
- A slight rise and fall of the chest and upper abdomen with each inflation.
- An improvement in oxygenation.

Oxygen use in resuscitation

- Term newborns: Use air (21%) initially.
- Preterm newborns <32 weeks: Use air or blended air and oxygen (21% to ~ 30% oxygen to start).
- Use air if a blender is not available.
- Supplemental oxygen should be used judiciously, ideally guided by pulse oximetry.

"The first priority is to ensure adequate inflation of the lungs, followed by increasing the concentration of inspired oxygen only if needed" (ARC & NZRC[2], 2010, Guideline 13.4)

Why is 100% oxygen a concern?

- Meta-analysis of RCT's showed increased survival rates of both term and preterm newborns who were resuscitated in air, compared with 100% oxygen. (Davis, *et al*., 2004[3])
- The use of 100% oxygen delays the time to first spontaneous breath and/or cry.[3,11]
- There is increasing evidence that even a brief period of excessive oxygenation can be harmful to the newborn during and after resuscitation.[2,10]

Assessment of oxygenation in the minutes after birth

- In-utero, the fetal SpO_2 is ~ 50 – 60%, dropping to an intra-partum mean of 40 – 50%.
- The normal newborn takes 5 -10 minutes to achieve an SpO_2 above 90% after birth.[4,6]
- Visual assessment of colour is difficult and a poor means of judging oxygenation.[9]
- A pulse oximeter can provide readings of heart rate and oxygen saturation less than 1 minute after application.[4,5,6]

Pulse oximetry is recommended:

- For all newborns requiring positive pressure ventilation or any form of respiratory support.
- Whenever supplemental oxygen is used.
- If persistent cyanosis is suspected.

- Place the oximeter onto the right hand or wrist (pre-ductal saturation measurements).

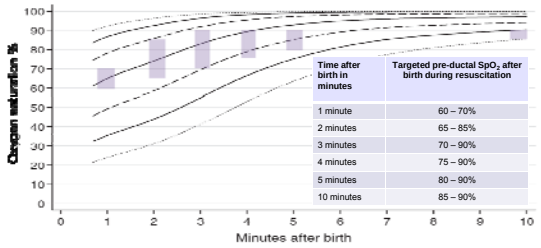
(ARC & NZRC[2], 2010, Guideline 13.3 and Guideline 13.4)

Target saturations for newborns during the first minutes after birth

Time after birth in minutes	Targeted pre-ductal SpO_2 after birth during resuscitation
1 minute	60 – 70%
2 minutes	65 – 85%
3 minutes	70 – 90%
4 minutes	75 – 90%
5 minutes	80 – 90%
10 minutes	85 – 90%

ARC & NZRC[2], 2010, Guideline 13.4

Centile charts with the ARC's targeted pre-ductal SpO_2 after birth



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5 minutes	80 – 90%
10 minutes	85 – 90%

Adapted from Dawson[4] *et al*., 2010 and the ARC & NZRC[2], 2010

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 H_2O if necessary
- Increase the oxygen according to SpO_2
  - Increase to 100% if the heart rate is <60/min

C:Circulation

At all stages ask: Do you need help?

Assessment
Heart rate below 60/min?

↓ **YES**

Actions *
Chest compressions at 90/minute
3 compressions to each breath
100% oxygen+
Consider intubation or LMA

↓ **YES**

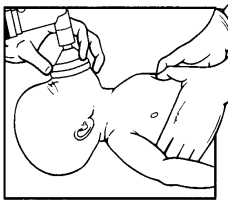
Assessment
Heart rate below 60/min?

↓ **YES**

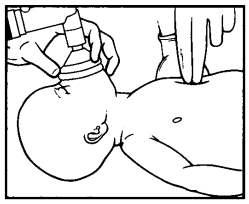
*** Endotracheal intubation should be considered**

+ Ensure the O_2 has been increased to 100% if the heart rate is <60/min

Techniques for ECC in newborns



Hand encircling, two thumb technique (preferred technique)

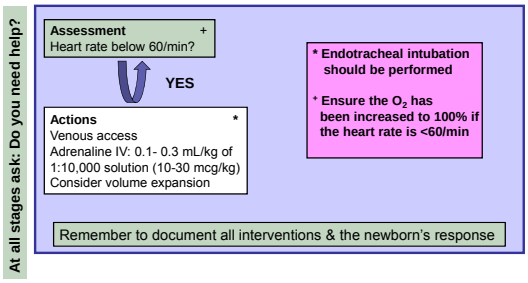


Two finger technique

Advanced resuscitation

- Advanced resuscitation interventions are indicated if first response interventions do not result in a rapid improvement in:
  - Heart rate, breathing, SpO_2 & muscle tone
- Such interventions include:
  - Intubation
  - Establishing umbilical venous or intraosseous access
  - Administration of adrenaline
  - Administration of volume expanders

D:Drugs



Preparing for advanced resuscitation

Select an appropriate size endotracheal tube according to estimated birth weight

Weight (kg)	ETT size (mm ID)
< 1 kg	2.5
1 – 2 kg	3.0
2 – 3 kg	3.5
> 3 kg	3.5/4.0

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

Prepare Adrenaline according to estimated birth weight

Adrenaline 1:10,000 solution	
Umbilical vein Peripheral IV Intraosseous	0.1- 0.3 mL/kg (10 - 30 mcg/kg)
Endotracheal tube (ETT)	0.5 - 1.0 mL/kg (50 - 100 mcg/kg)

For more information on:

- Intubation
- Use of a Pedi-Cap™ end tidal 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

- See the "Learning Resources" section of the NeoResus web site at http://www.neoresus.org.au/pages/edu.php

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