Guideline 13.4 – Airway Management and Mask Ventilation of the Newborn

Summary

ANZCOR Guidelines 13.1 to 13.10 and the Newborn Life Support algorithm are provided to assist in the resuscitation of newborn infants. Differences from the adult and paediatric guidelines reflect differences in the anatomy and physiology and the causes of cardiorespiratory arrest for newborns, older infants, children and adults. These guidelines draw from Neonatal Life Support 2020 and 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR), [1, 2] the development of which included representation from ANZCOR. The 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Care [3] and local practices have also been taken into account.

To whom do these guidelines apply?

The term ‘newborn’ or ‘newborn infant’ refers to the infant in the first minutes to hours following birth. In contrast, the neonatal period is defined as the first 28 days of life. Infancy includes the neonatal period and extends through the first 12 months of life.

ANZCOR Guidelines 13.1 to 13.10 and the Newborn Life Support algorithm are mainly for the care of newborns. The exact age at which paediatric techniques and in particular, compression-ventilation ratios, should replace the techniques recommended for newborns is unknown, especially in the case of very small preterm infants. For term infants beyond the first minutes to hours following birth, and particularly in those with known or suspected cardiac aetiology of their arrest, paediatric techniques may be used (refer to Paediatric Advanced Life Support ANZCOR Guidelines 12.1 to 12.7).

Who is the audience for these guidelines?

ANZCOR Guidelines 13.1 to 13.10 and the Newborn Life Support algorithm are for health professionals and those who provide healthcare in environments where equipment and drugs are available (such as a hospital). When parents are taught CPR for their infants who are being discharged from birth hospitals, the information in Basic Life Support Guidelines (ANZCOR Guidelines 2 to 8) is appropriate.

Recommendations

The Australian and New Zealand Committee on Resuscitation (ANZCOR) makes the following recommendations:

1. The newborn who needs resuscitation should be placed on their back with the head in a neutral or slightly extended position (the sniffing position). Particularly if moulding during birth has caused a very prominent occiput, a 2 cm thickness of blanket or towel placed under the shoulders may be helpful in maintaining good positioning. If respiratory efforts are present but not producing effective ventilation (the heart rate does not rise above 100 beats per min) the airway may be obstructed and consideration should be given to other methods to improve airway patency, including support of the lower jaw, opening the mouth, or in some cases upper airway suction. [Good Practice Statements]
2. In general, mouth and pharyngeal suction should not be used except when newborns show obvious signs of obstruction either to spontaneous breathing or to positive pressure ventilation and it should be done briefly and with care. Pharyngeal suction may be required to visualise the vocal cords during intubation. [Good Practice Statements]
3. Aspiration of meconium before or during birth, or during resuscitation can cause meconium aspiration syndrome (MAS) and all newborns born through meconium-stained fluid must be regarded as at risk. [Good Practice Statement]
4. Suctioning the newborns mouth and pharynx before the delivery of the shoulders makes no difference to the outcome of newborns with meconium-stained liquor and is not recommended. [Good practice statement NHMRC LOE II 2015]
5. For newborns who are vigorous after exposure to meconium-stained liquor, (breathing or crying, good muscle tone), routine endotracheal suctioning is discouraged because it does not alter their outcome and may cause harm. [Good practice statement NHMRC LOE II 2015]
6. For all newborns exposed to meconium-stained amniotic fluid, ANZCOR suggests against routine direct laryngoscopy immediately after birth, with or without tracheal suctioning. [CoSTR 2020 Weak recommendation, low-certainty evidence]
7. For the newborn needing assisted ventilation, the primary measure of effectiveness is a prompt improvement in heart rate, which is then sustained. Oxygen saturation levels should also improve. Chest wall movement and other indicators (for example auscultation, colorimetric CO^2 detector, respiratory function monitoring if available) of adequacy of lung inflation should be assessed if the heart rate does not improve. [Good Practice Statement]
8. If there is little or no visible chest wall movement the technique of ventilation should be improved. This includes assuring the facemask fits well on the face with minimal leak, and that the head and jaw position are correct. Two people may be able to provide mask ventilation more effectively than one, with one person supporting the jaw and holding the mask in place with two hands, and the other providing positive pressure inflations. If these manoeuvres are ineffective in moving the chest wall and increasing the heart rate, the inflating pressure must be increased until chest wall movement is seen and the heart rate increases. Suctioning of the airway is sometimes required. Occasionally an oropharyngeal airway may be helpful, such as when the newborn has an abnormally small jaw or large tongue. A nasopharyngeal airway may be a suitable alternative for those experienced in using them. [Good Practice Statements]
9. For spontaneously breathing term newborns with respiratory distress, a trial of CPAP may be considered, although there are no studies to support this recommendation. [Good Practice Statement]
10. A T-piece resuscitator device, a self-inflating bag (approximately 240 mL), and a flow-inflating bag are all acceptable devices to ventilate newborns either via a facemask, supraglottic airway or endotracheal tube. [Good Practice Statement]

11. ANZCOR suggests the use of a T-piece device for delivery of Intermittent Positive Pressure Ventilation (IPPV) or Continuous Positive Airway Pressure (CPAP) during newborn resuscitation. [Weak recommendation, very low certainty of evidence] A self-inflating bag must always be available for back-up in case of failure of pressurised gas delivery. [Good Practice Statement]
12. An appropriate size of facemask should be selected to seal around the mouth and nose but not cover the eyes or overlap the chin. Therefore, a range of sizes must be available for different sized babies. Masks with a cushioned rim are preferable to masks without one. The face mask should be applied using a rolling motion from chin to nose bridge and held in place using a suitable grip that minimises leaks. The optimal technique for mask grip varies with type of mask. Suction masks are not recommended. [Good Practice Statements]
13. For commencing intermittent positive pressure ventilation in newborns, the suggested initial pressures are 30 cm H_2O for term newborns and 20 to 25 cm H_2O for premature newborns. On devices that can deliver PEEP, 5 cm H_2O is the suggested initial setting. Pressures should be adjusted up or down according to response. For preterm newborns, it is particularly important to avoid creation of excessive lung expansion during ventilation immediately after birth. Although measured peak inspiratory pressure (PIP) does not correlate well with volume delivered in the context of changing respiratory mechanics, monitoring of inflation pressure may help provide consistent inflations and avoid unnecessarily high pressures and excessive volumes. [Good Practice Statements]
14. Higher inflation pressures may be required to aerate the lungs during the first few inflations than for subsequent inflations, particularly in newborns who have not made any respiratory effort. The minimal inflation required to achieve visible chest wall movement and an increase in heart rate should be used. When it becomes evident that the newborn is responding to ventilation, in many cases inflation pressures and rate can (and should) be decreased. [Good Practice Statements]
15. Subsequent ventilation should be provided at 40 to 60 inflations per minute with an inspiratory time of 0.3 to 0.5 seconds. For most newborns, ventilation can be accomplished with progressively lower pressures and rates as resuscitation proceeds. [Good Practice Statements]
16. ANZCOR suggests the use of PEEP (commencing at 5 to 8 cm H_2O pressure) during resuscitation of newborns wherever appropriate equipment is available. [Weak recommendation, very low certainty of evidence.]
17. High levels of PEEP (>8 cm H2O) have the potential to reduce pulmonary blood flow and cause pneumothorax and should be used with caution [Good Practice Statement].
18. If the chest and abdomen do not rise with each inflation, or the heart rate does not increase above 100 beats per minute, the technique of ventilation needs to be improved. Tracheal intubation (or use of a supraglottic airway) should be considered if ventilation via a facemask is still ineffective despite the above measures. [Good Practice Statements].
19. Oximetry is recommended when the need for resuscitation is anticipated, when CPAP or positive pressure ventilation is used, when persistent cyanosis is suspected, or when supplemental oxygen is used. [Good Practice Statement]
20. Use the following target range for oxygen saturations during newborn resuscitation. [Good Practice Statement]

Time from birth	**Target saturations for newborns during resuscitation in %**
1 min	60-70

2 min	65-85
3 min	70-90
4 min	75-90
5 min	80-90
10 min	85-90

21. For term and near-term newborn infants ANZCOR suggests that air should be used initially with supplemental oxygen reserved for those whose saturations do not meet the lower end of the targets despite respiratory support. [CoSTR 2020, weak recommendation, low certainty of evidence] If, despite effective ventilation there is no increase in oxygenation (assessed by oximetry wherever possible) or heart rate, a higher concentration of oxygen should be used. If the saturations reach 90% while supplemental oxygen is being administered, the concentration of oxygen should be decreased. [Good Practice Statement] (For considerations for very preterm infants refer to ANZCOR Guideline 13.8).
22. 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. [Good Practice Statement]
23. In all newborns, resuscitators should aim to ensure that effective spontaneous or assisted ventilation of the lungs has been established by 1 minute. The response to each set of actions in the algorithm should be assessed. If heart rate, breathing, tone and oxygenation do not improve or the newborn is deteriorating, progress to the next step. [Good Practice Statement]

Abbreviations

Abbreviation	**Meaning/Phrase**
ANZCOR	Australian and New Zealand Committee on Resuscitation
CI	Confidence interval (95%)
CoSTR	International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations
CPAP	Continuous positive airway pressure
CPR	Cardiopulmonary resuscitation
IPPV	Intermittent Positive Pressure Ventilation
ILCOR	International Liaison Committee on Resuscitation
LOE	Level of evidence
MAS	Meconium aspiration syndrome
NHMRC	National Health and Medical Research Council

PEEP	Positive end expiratory pressure
PIP	Peak inspiratory pressure
RCT	Randomised controlled trial

Guideline

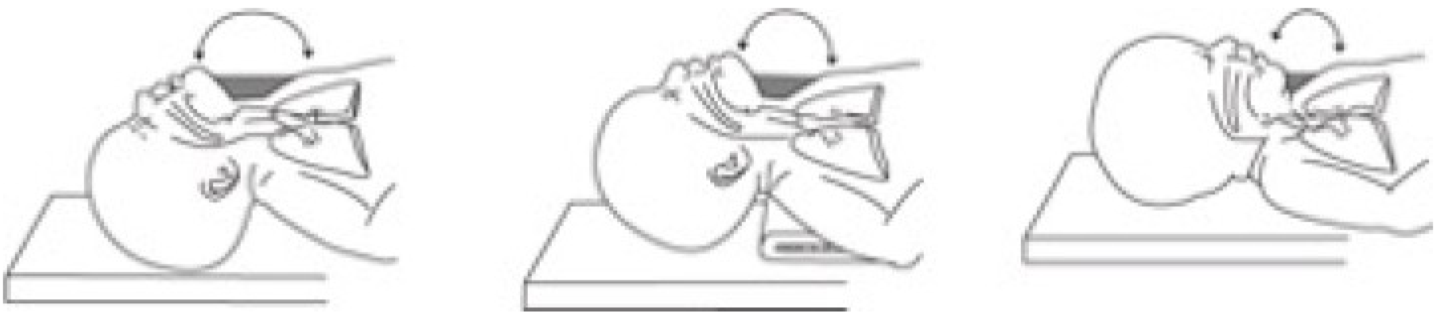
EFFECTIVE VENTILATION IS THE KEY TO SUCCESSFUL NEWBORN RESUSCITATION

All personnel involved in the birth and care of newborns must be familiar with the ventilation equipment and be proficient in its use.

1.0 | Positioning and the Airway

The newborn who needs resuscitation should be placed on their back with the head in a neutral or slightly extended position (the sniffing position). Particularly if moulding during birth has caused a very prominent occiput, a 2 cm thickness of blanket or towel placed under the shoulders may be helpful in maintaining good positioning. [Good Practice Statements]

Hyper-extended. Slightly extended. Flexed



The slightly extended, or sniffing position of the newborn illustrated in the middle panel results in optimal airway patency for resuscitation.

If respiratory efforts are present but not producing effective ventilation (the heart rate does not rise above 100 beats per min) the airway may be obstructed and consideration should be given to other methods to improve airway patency, including support of the lower jaw, opening the mouth, or in some cases upper airway suction. [Good Practice Statement]

1.1 | Mouth and Pharyngeal Suction

Newborns do not usually require suctioning of the nose, mouth or pharynx after birth. They clear their airways very effectively, and suctioning can delay the normal rise in oxygenation.[4] Evidence in relation to oropharyngeal and nasopharyngeal suctioning is limited, but overall, suggests it should not be used as a routine step in newborns receiving resuscitation. It is not expected to impact on liquid removal from the lungs. It may reduce oxygen saturation levels.[4, 5] and cause bradyarrhythmia.[6] It can take up time [7] that could result in clinically important delays in the newborn receiving other interventions, such as face mask ventilation.[8]

However, the airway is sometimes obstructed by particulate meconium, blood clots, tenacious mucous or vernix and these may need to be cleared.

In general, suction should not be used except when newborns show obvious signs of obstruction either to spontaneous breathing or to positive pressure ventilation and it should be done briefly and with care. Pharyngeal suction may be required to visualise the vocal cords during intubation. [Good Practice Statements]

1.2 | Management of the Airway in the Presence of Meconium-Stained Liquor

Aspiration of meconium before or during birth, or during resuscitation can cause meconium aspiration syndrome (MAS) and all newborns born through meconium-stained fluid must be regarded as at risk. [Good Practice Statement]

1.3 | Intrapartum pharyngeal suction

Suctioning the newborns mouth and pharynx before the delivery of the shoulders makes no difference to the outcome of newborns with meconium-stained liquor and is not recommended. [9, 10] [Good practice statement NHMRC LOE II 2015]

1.4 | Endotracheal suction

For newborns who are vigorous after exposure to meconium-stained liquor, (breathing or crying, good muscle tone), routine endotracheal suctioning is discouraged because it does not alter their outcome and may cause harm. [11, 12] [Good practice statement NHMRC LOE II 2015]

For non-vigorous infants (no breathing or crying, low muscle tone) a systematic review of tracheal suctioning (e.g. via an endotracheal tube) that included three randomised controlled trials (RCTs; 449 newborns) [13-15] and one observational study (231 newborns) [16] found no benefit for routine endotracheal suctioning for survival, neurodevelopmental outcomes, hypoxic ischaemic encephalopathy, meconium aspiration syndrome, need for chest compressions, use of various forms of respiratory support, need for treatment for pulmonary hypertension, or length of hospital stay. [17]

Emphasis should be placed on initiating ventilation rapidly in non-breathing or ineffectively breathing newborns. Rarely, a newborn may require intubation and tracheal suctioning to relieve airway obstruction. Meconium-stained amniotic fluid remains a significant risk factor for receiving advanced resuscitation at birth and for developing meconium aspiration syndrome.[18-20]

For all newborns exposed to meconium-stained amniotic fluid, ANZCOR suggests against routine direct laryngoscopy immediately after birth, with or without tracheal suctioning. [1] [CoSTR 2020 Weak recommendation, low-certainty evidence]

2.0 | Tactile Stimulation

Drying and stimulation are both assessment and resuscitative interventions. However, if in response, the term or preterm newborn fails to establish effective respirations and heart rate is below 100 beats per min by 1 minute of age and not increasing, Continuous Positive Airway Pressure (CPAP) or positive pressure ventilation should be commenced. If the newborn is breathing, CPAP may be sufficient to augment endogenous effort. In the non-breathing newborn Intermittent Positive Pressure Ventilation (IPPV) should be started. (Refer to ANZCOR Guideline 13.3).

3.0 | Positive Pressure Ventilation

After stimulation, positive pressure ventilation should be started if the heart rate is less than 100 beats per min and not increasing and either the newborn remains apnoeic or the breathing is inadequate. (Refer to ANZCOR Guideline 13.3).

The primary measure of effectiveness of ventilation is a prompt improvement in heart rate, which is then sustained. Oxygen saturation levels should also improve. Chest wall movement and other indicators (e.g., auscultation, colorimetric CO_2 detector, respiratory function monitoring) of adequacy of lung inflation should be assessed if the heart rate does not improve. [Good Practice Statement]

If there is little or no visible chest wall movement the technique of ventilation should be improved. This includes assuring the facemask fits well on the face with minimal leak, and that the head and jaw position are correct. Two people may be able to provide mask ventilation more effectively than one, with one person supporting the jaw and holding the mask in place with two hands, and the other providing positive pressure inflations. [21, 22] If these manoeuvres are ineffective in moving the chest wall and increasing the heart rate, the inflating pressure must be increased until chest wall movement is seen and the heart rate increases. Suctioning of the airway is sometimes required. Occasionally an oropharyngeal airway may be helpful, such as when the newborn has an abnormally small jaw or large tongue. A nasopharyngeal airway may be a suitable alternative for those experienced in using them. [Good Practice Statements]

3.1 | Manual Ventilation Devices

A T-piece device, a self-inflating bag (approximately 240 mL), and a flow-inflating bag are all acceptable devices to ventilate newborns either via a facemask, supraglottic airway or endotracheal tube. [23-30] [Good Practice Statement]

	T-piece resuscitation device (with manometer)	Self-inflating bag	Flow-inflating bag (with manometer)
Needs pressurised gas source	Yes	No	Yes
Assists user to detect mask leak	Yes	No	Yes
Peak inflation pressures	Consistent, adjustable	Inconsistent, may be very high	Consistency depends on user skills
Delivers PEEP or CPAP	Yes	No	Depends on user skills
Can deliver sustained inflation	Yes	No	Depends on user skills

3.2 | Effectiveness of T-piece Resuscitator Devices Versus Self-Inflating Bags

ANZCOR suggests using a T-piece device for delivery of Intermittent Positive Pressure Ventilation (IPPV) or Continuous Positive Airway Pressure (CPAP) during newborn resuscitation. [23] [Weak recommendation, very low certainty of evidence] In making this suggestion, we have diverged from the 2020 CoSTR Treatment Recommendation, which did not change a 2010 ILCOR conclusion that there was insufficient evidence to recommend T-piece resuscitators over self-inflating bags. [1, 2] In doing so, we take into account a recently published ILCOR systematic review which found evidence suggesting reduced rates of mortality, bronchopulmonary dysplasia and rates of intubation for resuscitation when using a T-piece resuscitator, [23] as well as the level of resources for health care in Australia and New Zealand. We also place value on the demonstrated benefits of positive end expiratory pressure (PEEP) in recruiting lung volume, the routine use of manometry to adjust inflating pressures and the reliable titration of oxygen concentration.

A flow-inflating bag with manometer is also suitable. The T-piece device or flow-inflating bag should be used with a blender and both compressed air and oxygen, to allow accurate titration of inspired oxygen concentration to meet the newborn’s needs.

A self-inflating bag must always be available for back-up in case of failure of pressurised gas delivery. [Good Practice Statement] A self-inflating bag cannot deliver CPAP and may not be able to achieve PEEP even with a PEEP valve in place. [31]

3.3 | Facemasks

The appropriate size of facemask must seal around the mouth and nose but not cover the eyes or overlap the chin. Therefore, a range of sizes must be available for different sized babies. Masks with a cushioned rim are preferable to masks without one. [32] [Good Practice Statements] With face mask ventilation it can be difficult to establish and maintain a good seal between the mask and the infant’s face [33] and so it cannot be assumed that just because the mask is on the

face, there is a good seal.

Suitable facemasks, with cushioned rims, are shown on the left. The one in the centre has an inflatable rim, which should be filled with air using a syringe until the rim is firm. The Rendell Baker style mask on the right should not be used.

The face mask should be applied using a rolling motion from chin to nose bridge and held in place using a suitable grip that minimises leaks. [22, 34] The optimal technique for mask grip varies with type of mask. Suction masks are not recommended. [35] [Good Practice Statements]

3.4 | Initiating Ventilation

The aim of ventilation is initially to clear lung liquid, establish lung aeration and enable gas exchange.[36-39] The optimal strategy for this in newborns needing resuscitation has not been established. There is evidence from animal studies to support sustained inflations and positive end expiratory pressure, [40]particularly in preterm lungs. However, care must be taken to avoid high tidal volumes during resuscitation, which can cause sustained damage to immature lungs. [41]

For term or late preterm newborns, it is not possible to recommend any specific duration for initial inflations because there are no published comparative trials.[1, 42] For advice for ≤ 32 week preterm newborns who receive positive pressure ventilation at birth, refer to ANZCOR Guideline 13.8.

For commencing intermittent positive pressure ventilation in newborns, the suggested initial pressures are 30 cm H_2O for term newborns and 20 to 25 cm H_2O for premature newborns.

On devices that can deliver PEEP, 5 cm H_2O is the suggested initial setting. Pressures should be adjusted up or down according to response. For preterm newborns, it is particularly important to avoid creation of excessive lung expansion during ventilation immediately after birth. Although measured peak inspiratory pressure (PIP) does not correlate well with volume delivered in the context of changing respiratory mechanics, monitoring of inflation pressure may help provide consistent inflations and avoid unnecessarily high pressures and excessive volumes. [43] [Good Practice Statements]

Higher inflation pressures may be required to aerate the lungs during the first few inflations than for subsequent inflations, particularly in newborns who have not made any respiratory effort. The minimal inflation required to achieve visible chest wall movement and an increase in heart rate should be used. When it becomes evident that the newborn is responding to ventilation, in many cases inflation pressures and rate can (and should) be decreased. [Good Practice Statements]

Subsequent ventilation should be provided at 40 to 60 inflations per minute with an inspiratory time of 0.3 to 0.5 seconds. ***For most newborns, ventilation can be accomplished with progressively lower pressures and rates as resuscitation proceeds.*** [Good Practice Statements]

3.5 | PEEP during Resuscitation

PEEP has been shown to be very effective for improving lung volume, reducing oxygen requirements and reducing the incidence of apnoea in preterm infants with respiratory distress syndrome. [44] Studies in intubated premature animals demonstrate that it helps establish aerated lung volume. [45, 46]

There is low certainty evidence indicating that PEEP produces a modest reduction in maximum oxygen concentration during preterm infant's resuscitation. [47] Most human newborn trials compare devices that can deliver PEEP (such as T-piece devices) with devices that cannot deliver PEEP (such as self-inflating bags), [48-52] These devices cause other major differences in the inflation pressure profile that may confound any relationship between the use of PEEP and clinical outcomes. Therefore, we place higher value on the evidence for routine use of PEEP during ventilation in newborns receiving subsequent newborn intensive care, the demonstrated benefits of PEEP in establishing lung aeration in newborn preterm animal models and the much stronger evidence that CPAP can be used to support spontaneous breathing in term and preterm newborns with a variety of lung disorders. We place lower value on the absence of evidence of other benefits from human infant trials. [2, 53] Therefore, ANZCOR suggests the use of PEEP (commencing at 5 to 8 cm H_2O pressure) during resuscitation of newborns wherever appropriate equipment is available. [1, 2] [Weak recommendation, very low certainty of evidence]

High levels of PEEP (>8 cm H_2O) have the potential to reduce pulmonary blood flow and cause pneumothorax, and should be used with caution. [50] [Good Practice Statement]

3.6 | Assessing the Effectiveness of Ventilation

The effectiveness of ventilation is confirmed by observing three things:

1. Increase in the heart rate above 100 beats per minute.
2. A slight rise of the chest and upper abdomen with each inflation.
3. Oxygenation improves.

If the chest and abdomen do not rise with each inflation, or the heart rate does not increase above 100 beats per minute, the technique of ventilation needs to be improved. Tracheal intubation (or use of a supraglottic airway) should be considered if ventilation via a facemask is still ineffective despite the above measures. [Good Practice Statements]

3.7 | Continuous Positive Airway Pressure (CPAP)

For spontaneously breathing term newborns with respiratory distress, a trial of CPAP may be considered, although there are no randomised trials to support this recommendation. [54, 55] [Good Practice Statement] For preterm newborns, refer to ANZCOR Guideline 13.8.

3.8 | Mouth-to-Mouth/Nose and Mouth-to-Mask Ventilation

Where newborn inflation devices are not available, mouth-to-mouth-and-nose ventilation can be used. [56] Maternal blood and other body fluids should first be wiped from the face of the newborn. The rescuer should then apply the mouth over the mouth and nose of the newborn and give small puffs at a rate of 40 to 60 breaths per minute to produce a small rise and fall of the chest, until the newborn improves.

4.0 | Supplemental Oxygen during Resuscitation

There are now many studies showing that the blood oxygen levels of normal newborns can take up to 10 minutes to rise above 90%. [57-63] While insufficient oxygenation can impair organ function or cause permanent injury, there is increasing evidence that even brief exposure to excessive oxygenation can be harmful to the newborn during and after resuscitation. [64-68]

Furthermore, visual assessment of the presence or absence of cyanosis bears a poor relationship to oxyhaemoglobin saturation measured with an oximeter. [69]

4.1 | Pulse oximetry

Oximetry is recommended when the need for resuscitation is anticipated, when CPAP or positive pressure ventilation is used, when persistent cyanosis is suspected, or when supplemental oxygen is used. [Good Practice Statement] (Refer to ANZCOR Guideline 13.3)

4.2 | Administration of supplemental oxygen

Meta-analyses of randomized controlled trials comparing newborn resuscitation initiated in 21% versus 100% oxygen showed increased survival in newborns for whom resuscitation was initiated with air. [70, 71 72] In the studies of term newborns receiving resuscitation with intermittent positive pressure ventilation, 100% oxygen conferred no short term advantage and resulted in increased time to first breath and/or cry. [73, 74] However, there are no studies in term newborns that compare commencing on oxygen concentrations other than 21% or 100%.

It is suggested that regardless of gestation, the goal of oxygen administration should be to aim for oxygen saturations resembling those of healthy term newborns. The interquartile range of pre-ductal saturations measured in normal term newborns at sea level are suitable targets. [68] Use the following target range. [Good Practice Statement] Although the 75th centile for normal newborns rises above 90%[63], in the following table the upper saturation targets while administering oxygen have been capped at 90%, to avoid risk of exposing newborns to excessive oxygen, as when the SpO_2 is >90%, the arterial partial pressure of oxygen (PaO_2) can be very high. Some newborns achieve saturations over 90% without supplemental oxygen.

Time from birth	**Target saturations for newborns during resuscitation in %**
1 min	60-70
2 min	65-85
3 min	70-90
4 min	75-90
5 min	80-90
10 min	85-90

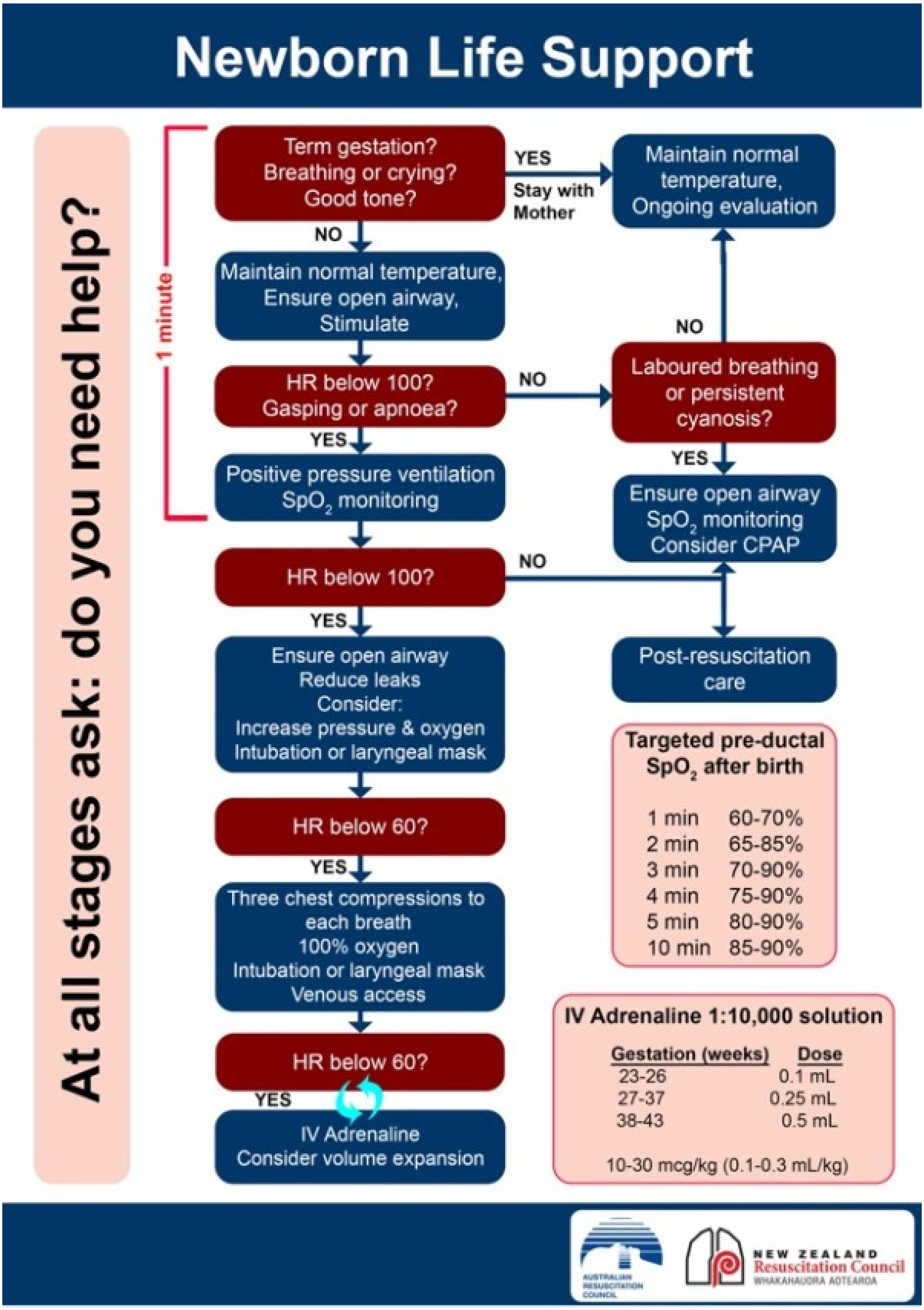
For term and near-term newborn infants ANZCOR suggests that air should be used initially with supplemental oxygen reserved for those whose saturations do not meet the lower end of the targets despite respiratory support. [1, 72] [CoSTR 2020, weak recommendation, low certainty of evidence] If, despite effective ventilation there is no increase in oxygenation (assessed by oximetry wherever possible) or heart rate, a higher concentration of oxygen should be used. [2, 75-77] If the saturations reach 90% while supplemental oxygen is being administered, the concentration of oxygen should be decreased. [Good Practice Statement]

For considerations of very preterm infants, refer to ANZCOR Guideline 13.8.

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. [Good Practice Statement]

5.0 | Pace of Resuscitation

In all newborns, resuscitators should aim to ensure that effective spontaneous or assisted ventilation of the lungs has been established by 1 minute. The response to each set of actions in the algorithm should be assessed. If heart rate, breathing, tone and oxygenation do not improve or the newborn is deteriorating, progress to the next step. [Good Practice Statement]



Footnote; Laryngeal mask is synonymous with supraglottic airway.

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About this Guideline

Search date/s	ILCOR literature search details and dates are available on the CoSTR page of the ILCOR website (https://costr.ilcor.org) and the relevant CoSTR documents. [1, 2]
Questions/PICOs:	Are described in the CoSTR documents (https://costr.ilcor.org)
Method:	Mixed methods including ARC NHMRC methodology before 2017 and ILCOR GRADE methodology described in ILCOR publications since 2017.
Principal reviewers:	Helen Liley, Lindsay Mildenhall, Marta Thio, Callum Gately
Main changes:	Changes in recommendations for non-vigorous infants exposed to meconium-stained amniotic fluid. Updates for clarity and consistency with contemporary good practice. Updating of review evidence, references, and terminology to increase consistency with GRADE terminology.
Approved:	April 2021

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