



**Australian  
Resuscitation  
Council**



**NEW ZEALAND  
Resuscitation Council**  
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## Guideline 12.2 – Paediatric Advanced Life Support (PALS)

### Summary

[ANZCOR Guidelines 12.1 to 12.5](#) are provided to assist health professionals in the resuscitation of children. Differences from the adult and newborn guidelines reflect differences in the causes of cardiorespiratory arrest in, and anatomy and physiology of newborns, older infants, children and adults. These guidelines draw from the Paediatric Life Support 2025 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations,<sup>1</sup> the development of which included representation from the Australian and New Zealand Committee on Resuscitation (ANZCOR). The 2025 European Resuscitation Council Paediatric Life Support guidelines,<sup>2</sup> 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Care,<sup>3,4</sup> previous Paediatric Life Support International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations<sup>5-25</sup> statements and local practices have also been considered.

ANZCOR Guideline 12.2 focuses on paediatric resuscitation in healthcare settings (pre-hospital or hospital) by health professionals responsible for the care of infants and children. It should be read in conjunction with the other paediatric guidelines ([ANZCOR Guidelines 12.1 to 12.5](#)) and the general life support guidelines suitable for all age groups ([ANZCOR Guidelines 2 to 8](#)).

### To whom does this guideline apply?

This guideline applies to infants and children requiring paediatric advanced life support (PALS) in a healthcare environment (pre-hospital or hospital).

### Who is the audience for this guideline?

This guideline is intended for health professionals who care for infants and children in healthcare environments where resuscitation equipment and medications are available.

It represents the next steps in the continuum of care from bystander basic life support (BLS) and/or

health professional paediatric basic life support (PBLs) through to use and availability of more advanced skills and resources allowing provision of PALS.

## 1.0 | About this Guideline

Search date/s	ILCOR literature search details and dates are available on the CoSTR page of the ILCOR website ( <a href="https://costr.ilcor.org">https://costr.ilcor.org</a> ) and relevant CoSTR documents.
Questions/PICOs:	Are described in the CoSTR documents ( <a href="https://costr.ilcor.org">https://costr.ilcor.org</a> )
Method:	<p>The guideline process includes involvement of stakeholders from member organisations of the Australian Resuscitation Council &amp; New Zealand Resuscitation Council, and peer review by members of the Australian and New Zealand Committee on Resuscitation (ANZCOR). Details of the guideline development process can be found on the ANZCOR website at <a href="http://www.anzcor.org">www.anzcor.org</a>.</p> <p>The ANZCOR treatment recommendations provided (highlighted in grey boxes) bring together the available resuscitation evidence and clinical expertise. If an ANZCOR treatment recommendation is obtained from the ILCOR CoSTR, that statement will be referenced. Where the development of a recommendation has been based on “expert consensus opinion”, this will be labelled as either an ILCOR Good Practice Statement or an ANZCOR Good Practice Statement. Some paediatric doses are provided for reference but practitioners should comply with local drug dosing guidelines.</p>
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## Abbreviations

Abbreviation	Meaning/Phrase	
AED	automated external defibrillator	
ALS	advanced life support	
ANZCOR	Australian and New Zealand Committee on Resuscitation	
AL	antero-lateral	
AP	anterior-posterior	
BLS	basic life support	
BMV	bag-mask ventilation	
CO <sub>2</sub>	carbon dioxide	
CoSTR	Consensus on Science with Treatment Recommendations	

CPR	cardiopulmonary resuscitation	
DBP	diastolic blood pressure	
ECG	electrocardiograph	
ETCO <sub>2</sub>	end tidal carbon dioxide	
ETT	endotracheal tube	
IHCA	in-hospital cardiac arrest	
ILCOR	International Liaison Committee on Resuscitation	
IO	intraosseous	
IV	intravenous	
MET	Medical Emergency Team	
NIRS	near-infrared spectroscopy	
NPA	nasopharyngeal airway	
OHCA	out-of-hospital cardiac arrest	
OPA	oropharyngeal airway	
PALS	paediatric advanced life support	
PaO <sub>2</sub>	partial pressure of arterial oxygenation	
PBLS	paediatric basic life support	
PEA	pulseless electrical activity	
POCUS	point of care ultrasound	
pVT	pulseless ventricular tachycardia	
RCT	randomised control trial	
ROSC	return of spontaneous circulation	
RRT	Rapid Response Team	
rSO <sub>2</sub>	regional cerebral oxygen saturation	
SGA	supraglottic airway	
SaO <sub>2</sub>	arterial oxygen saturation	
SpO <sub>2</sub>	pulse oximetry	
VF	ventricular fibrillation	
VT	ventricular tachycardia	

## Summary of Changes

The main changes made in this latest update to the ANZCOR Guideline 12.2 include:

Section	Updated Guidance	Previous Guidance
5.0	In infants and children who are unresponsive and breathing is absent (or agonal), healthcare providers should begin cardiopulmonary resuscitation (CPR).	In infants and children who are unresponsive and not breathing normally, healthcare providers should begin CPR unless they can definitely feel a pulse within 10 seconds.
9.1	ANZCOR suggest that external cardiac compression should be started while rescuers wait for a bag-mask ventilation (BMV) device to arrive. If a BMV device is immediately available, 2 initial ventilations should be provided before commencement of external cardiac compression.	ANZCOR suggest that two initial ventilations should be provided before commencement of external cardiac compressions because asphyxial causes are more common than cardiac causes in paediatric cardiorespiratory arrest. In circumstances where the usual equipment used to provide ventilations (e.g. BVM) is not immediately available, CPR should be commenced immediately with chest compressions.
9.2	ANZCOR suggest the use of BMV rather than endotracheal tube (ETT) or supraglottic airway (SGA) insertion in the management of children during cardiac arrest in the out-of-hospital setting. ANZCOR suggest that clinicians consider transitioning to an advanced airway intervention (SGA or ETT) when the team has sufficient expertise, resources, and equipment to allow SGA/ETT placement to occur with minimal interruptions to chest compressions or when BMV is not providing adequate oxygenation/ventilation.	ANZCOR suggest the use of BVM ventilation rather than ETT or SGA insertion in the management of children during cardiac arrest in the out-of-hospital setting.
9.5	ANZCOR suggest that cuffed tracheal tubes are used for emergency intubation of infants (>28 days and >3kg) and children. If cuffed tracheal tubes are used, avoid excessive cuff pressures.	ANZCOR suggest that both cuffed and uncuffed tracheal tubes are acceptable for use in infants and children undergoing emergency intubation.
9.7	ANZCOR suggest that, after placement of a secure airway, ventilation rates close to age-appropriate respiratory rates should be used, with avoidance of hypoventilation and hyperventilation. ANZCOR suggest a ventilation rate approximating 30 breaths/minute for infants and 25 breaths/minute for older children (>1 year).	ANZCOR suggest that, after placement of a secure airway, avoid hyperventilation of infants and children during resuscitation from cardiac arrest, whether asphyxial or arrhythmic in origin. A reduction in minute ventilation to less than baseline for age is reasonable to provide sufficient ventilation to maintain adequate ventilation-to-perfusion ratio during CPR while avoiding the harmful effects of hyperventilation.

10.2	ANZCOR suggest that chest compression for an infant be performed with the two-thumb encircling technique as it results in consistently greater chest compression depth and less fatigue. Chest compression for an infant using the heel of one hand may be considered if the rescuer is unable to achieve optimal compression depth using the two-thumb encircling technique.	Chest compression for an infant can be performed with the two-thumb technique or two-finger technique. The two-thumb technique is the strongly preferred technique for healthcare rescuers.
12.2	If hypovolaemia is suspected as the cause of cardiorespiratory arrest, intravenous (IV) or intraosseous (IO) crystalloid (e.g. 0.9% Sodium Chloride) may be used initially for resuscitation as a bolus of 10mL/kg.	If hypovolaemia is suspected as the cause of cardiorespiratory arrest, IV or IO crystalloid may be used initially for resuscitation as a bolus of 10 to 20mL/kg.
13.1	CPR providers using manual defibrillation in infants and children, place pads in an anterior-posterior position.	Pads allow chest compression to continue while charging, probably permit faster resumption of chest compression after delivery of a shock, may be safer and may allow easier use of an antero-posterior position which may be more efficacious than the standard antero-lateral positions of pads.
13.3	ANZCOR suggest a single-shock strategy followed by immediate CPR (beginning with chest compressions) for children with out-of-hospital cardiac arrest (OHCA) or in-hospital cardiac arrest (IHCA) with ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT).	Three stacked shocks may be considered when the onset of a shockable rhythm is witnessed (with monitoring) in special circumstances such as: <ul style="list-style-type: none"> <li>· In the cardiac catheter laboratory</li> <li>· In the ICU or cardiac ward post cardiac surgery</li> <li>· In other circumstances when a defibrillator is already attached.</li> </ul>
16.3	ANZCOR suggest that end tidal carbon dioxide (ETCO <sub>2</sub> ) be considered as a part of cardiac arrest monitoring in infants and children to provide feedback on the quality of CPR and to help early identification of return of spontaneous circulation (ROSC).	A recommendation is still too speculative.
16.5	ANZCOR suggest targeting an intra-arrest diastolic blood pressure of ≥25 mmHg for infants <1 year and ≥30 mmHg for children 1 to 18 years when invasive blood pressure monitoring is in place at the time of cardiac arrest.	For children with IHCA and an arterial line already in place, hemodynamic-directed CPR may be considered but at present the confidence in effect estimates is so low that a recommendation is too speculative.

18.0	<p>ANZCOR suggest that family members be provided with the option to be present during resuscitation from cardiac arrest Policies or protocols about family presence during resuscitation should be developed to guide and support health care professional decision-making. When implementing family presence procedures, healthcare providers should receive education about family presence during cardiac arrest resuscitation, including how to manage these stressful situations, family distress and their own responses to these situations.</p>	<p>ANZCOR suggest that family members of patients undergoing resuscitation should be given the option to be present, ideally with an assigned support person. Each healthcare institution should have a family presence policy and staff education strategy in place.</p>
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## 2.0 | Introduction

This guideline is provided by ANZCOR to assist health professionals responding to significant clinical deterioration or cardiorespiratory arrest in infants and children in healthcare settings. For health professionals caring for both adults and children, this guideline should act as an adjunct to the Advanced Life Support (ALS) guidelines for adults published by ANZCOR (Section 11). Differences between paediatric and adult guidelines reflect differences in the causes of cardiorespiratory arrest and differences in anatomy and physiology between infants, children and adults. Differences from paediatric basic life support (PBLS) recommendations (Refer to [ANZCOR Guideline 12.1](#)) reflect the availability of different equipment and the expected higher degree of skill/experience required for paediatric advanced life support.

ANZCOR Guideline 12.2 is focused on paediatric advanced life support (PALS), i.e. resuscitation with the aid of equipment and medications to restore and maintain airway, breathing and circulation in infants and children in a healthcare environment where cardiorespiratory arrest may be encountered. It applies to children and infants (excluding newborns, i.e. at the time of birth). The guideline does not refer in detail to the resuscitation of the newborn, which may be found in [ANZCOR Guidelines 13.1 to 13.10](#).

Because equipment may not be immediately available in healthcare settings, PALS should be seen as the next stage in the continuum from basic life support (BLS) or PBLS (resuscitation without equipment and medications). Further details of PBLS for infants and children may be found in [ANZCOR Guideline 12.1](#).

## 2.0 | Terminology

Definitions of 'newborn', 'infant' and 'child' are based on combinations of physiology, age and physical size, which influence the efficacy and practicality of performing resuscitative techniques.

For the purposes of paediatric life support guidelines, paediatric patients include infants (0 to 12 months of age, i.e. up to their first birthday) and children (>12 months to <18 years), excluding newborns. The term 'newborn' refers to an infant at the time of birth.

From a practical perspective, if the rescuer believes that the patient is a child, then they should follow paediatric guidelines, and adult guidelines should be used for anyone who appears to be an adult. If the patient turns out to be a young adult, it is unlikely that any harm will have been done as the paediatric pattern of cardiorespiratory arrest has been demonstrated to continue into early adulthood.<sup>20</sup>

The exact age at which paediatric techniques, particularly the compression-ventilation ratio, should replace those used for newborns is not certain, especially for small premature infants. Infants whose cardiorespiratory physiology is in transition from an intra-uterine environment at birth to several hours after birth (i.e. newborns) should preferably be managed as per neonatal guidelines (ANZCOR Guidelines Section 13). Infants aged more than a few hours beyond birth should be managed according to paediatric guidelines (with a compression-ventilation ratio of 15:2) in the pre-hospital, emergency department, paediatric inpatient and paediatric intensive care unit environments.<sup>25</sup>

## 3.0 | Epidemiology of cardiorespiratory arrest in infants and children

Cardiorespiratory arrest may occur as the end result of a wide variety of conditions in infants and children. In the paediatric population, cardiorespiratory arrest is more often secondary to respiratory (e.g. hypoxaemia secondary to respiratory infection, trauma, drowning or poisoning) or circulatory failure (e.g. hypotension secondary to septicaemia or trauma) rather than a primary arrest from an arrhythmia.

The initial cardiac rhythm discovered is usually (85%) asystole or pulseless electrical activity (PEA).<sup>26</sup> The incidence of ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT) as the initial rhythm is approximately 15%.<sup>26</sup> VF may be present more commonly as the initial presenting rhythm in association with congenital heart conditions, poisoning with cardioactive medications and membrane ion channelopathies such as congenital long QT syndrome. When VF is encountered later in the course of resuscitation, it is more likely to represent an agonal rhythm. Respiratory arrest may occur alone, but if not treated promptly, it may rapidly progress to cardiac arrest.

## 4.0 | Preventing cardiorespiratory arrest: recognition of deterioration & paediatric rapid response systems

Cardiorespiratory arrest in children is usually preceded by a period of recognisable deteriorating respiratory or cardiovascular function (or both) and is therefore often predictable and may be preventable. If deterioration is recognised and treated early, cardiorespiratory arrest may be prevented. However, many barriers to recognition and treatment of a child with a deteriorating illness exist.<sup>27</sup>

Paediatric rapid response systems - medical emergency team (MET) or rapid response team (RRT) systems – may help to reduce the incidence of respiratory and/or cardiac arrest in hospitalised children (outside of the intensive care setting) and may reduce hospital mortality.<sup>28, 29</sup> An evidence update performed as part of the International Liaison Committee on Resuscitation (ILCOR) 2020 process<sup>14</sup> identified a number of additional studies addressing this topic but findings were not sufficiently different to change the ILCOR 2015 recommendation.<sup>21</sup>

ANZCOR suggest that paediatric rapid response systems should be implemented in all hospitals that care for children [CoSTR 2015, weak recommendation, very low-certainty of evidence].

Triggers for activation of rapid response systems may include single-parameter or multi-parameter aggregate scores (early warning scores) and may incorporate activation for clinician or family concern. The ILCOR PLS Taskforce conducted a systematic review on this topic in 2022.<sup>30</sup> Implementation of any paediatric early warning score should be part of an overall clinical response system, with a higher value placed on improving healthcare provider ability to recognise and intervene for patients with deteriorating illness over the expense incurred by a healthcare system committing significant resources to implementation.

ANZCOR suggest using paediatric early warning systems to monitor hospitalised children, with the aim of identifying those who may be deteriorating [CoSTR 2022, weak recommendation, low-certainty evidence].

## 5.0 | Recognising cardiorespiratory arrest

Cardiorespiratory arrest should be suspected in a child or infant who is unresponsive and breathing is absent (or agonal). Health professionals may be alerted to cardiac arrest by changes in monitored patients (e.g. loss of blood pressure, pulse oximetry (SpO<sub>2</sub>), or end-tidal carbon dioxide (ETCO<sub>2</sub>) waveforms).

A systematic review<sup>31</sup> conducted as part of the ILCOR 2025 process identified 3 studies with 39 patients and 376 pulse checks, providing very low certainty of evidence. All studies had a serious risk of bias. Sensitivity ranged from 76% to 100%, and specificity 64% to 79%.

ANZCOR suggest that palpation of a pulse (or its absence) is not reliable as the sole determinant of cardiac arrest and need for chest compressions [CoSTR 2025, weak recommendation, very low-certainty evidence]. In infants and children who are unresponsive and breathing is absent (or agonal), healthcare providers should begin CPR [ILCOR Good Practice Statement].

## 6.0 | Sequence of actions in Paediatric ALS

Resuscitation should commence immediately with basic techniques in the healthcare setting and continue with the aid of medications and equipment as soon as these become available. Paediatric Advanced Life Support (PALS) may include the preservation of a patent airway by endotracheal intubation or other device, the provision of positive pressure ventilation via mechanical devices with oxygen, the treatment of cardiac arrhythmias, the treatment of the cause of cardiorespiratory arrest and the treatment of complications arising from its management.

When several rescuers are in attendance, initial actions, including bag-mask ventilation (BMV) or ventilation via an advanced airway device (if already in place), attaching monitoring equipment, and access to the circulation, should be attempted simultaneously, while minimising interruptions to chest compressions. Thereafter, treatment should be guided by the cardiac rhythm.

Once the defibrillator arrives, the electrocardiograph (ECG) may be displayed using chest leads or defibrillator pads. The type of arrhythmia present will determine treatment choice of either medication therapy or immediate defibrillation, while chest compressions and assisted ventilation (with oxygen) are continued.

## 7.0 | Team-based approach to resuscitation

Although the sequence of actions in a resuscitation is usually described as a series of prioritised steps, PALS is a team activity, and multiple urgent interventions will be performed safely and effectively in parallel. Paediatric resuscitation teams should not only train in the knowledge and skills for PALS but also in the teamwork and coordination aspects of efficient PALS interventions.

## 8.0 | Airway & oxygen therapy

Optimising airway patency and provision of effective ventilation and oxygenation are central components in the management of critically ill or injured children.

## 8.1 | Oxygen therapy

Both hypoxaemia and hyperoxaemia may have harmful effects and prolonged exposure to either should be avoided. Studies involving newborns have previously demonstrated advantages of using room air (rather than oxygen) during resuscitation, but this has not been shown for infants and older children.

The ILCOR PLS Task Force conducted a scoping review in 2020<sup>15</sup> and an EvUp in 2023<sup>8</sup> to determine if new evidence was available to support a specific inspired oxygen concentration to use during attempted resuscitation of infants and children. Neither review identified any new human studies in infants (beyond the neonatal period) or children regarding oxygen concentration or its titration during cardiopulmonary resuscitation. The lack of human studies in infants or children that addressed the topic, and the indirectness of results from animal models were considered insufficient to alter the existing 2010 recommendations.<sup>24</sup>

As there is currently insufficient information to recommend a specific inspired oxygen concentration for ventilation during attempted resuscitation after cardiac arrest in infants and children.

ANZCOR suggest that the highest concentration of oxygen available (100%) should be administered during initial resuscitation regardless of any preceding condition [ANZCOR Good Practice Statement].

Once ROSC is obtained, the concentration of oxygen delivered should then be titrated to aim for normal partial pressure of arterial oxygenation ( $\text{PaO}_2$ ) (Refer to [ANZCOR Guideline 12.5](#)).

In children who are breathing spontaneously, oxygen delivery may be supplemented by using nasal cannulae or appropriately sized oxygen face masks (preferably with a reservoir). In apnoeic patients, ventilation should be established using either a self-inflating BMV device or a modified Ayre's T-piece circuit (connected to oxygen).

Most self-inflating BMV devices should not be used to deliver oxygen to the child who is breathing spontaneously because minimal and unreliable amounts of oxygen are released passively from the exit valve.<sup>32</sup>

## 8.2 | Airway positioning & manoeuvres

Airway opening manoeuvres, including backward head tilt with chin lift (Figures 1 & 2) or jaw thrust (Figures 3 & 4), may be used to optimise the position of the infant's or child's airway. Hyperextension of the neck should be avoided as it may cause airway obstruction, especially in

small infants.

ANZCOR suggest that if a neck injury is suspected, only jaw thrust should be used to avoid worsening the injury [ANZCOR Good Practice Statement].

The patency of the airway should be assessed by observation of movement of the chest and abdomen during breathing. An indrawing of the chest wall and/or distension of the abdomen with each inspiratory effort without expiration of air implies an obstructed airway.



**Figure 1: Head tilt with chin lift in an infant**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]



**Figure 2: Head tilt with chin lift in a child**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]



**Figure 3: Jaw thrust in an infant**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]



**Figure 4: Jaw thrust in a child**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]

## 8.3 | Airway clearance

If airway obstruction is not relieved by backward head tilt with chin lift or by jaw thrust, the pharynx should be inspected with the aid of a tongue depressor or laryngoscope and cleared of any secretions, vomitus or blood using a pharyngeal suction device (e.g. Yankauer). Magill forceps may be used to extract a foreign body.

## 8.4 | Airway adjuncts

Establishment and maintenance of an airway may be facilitated with an oropharyngeal (OPA) or nasopharyngeal airway (NPA). It is important to note that these adjuncts do not protect the airway from aspiration of blood or secretions.

An oropharyngeal (Guedel) airway may help to open the airway in an unconscious child who has no gag reflex. Nasopharyngeal airways are usually better tolerated in conscious or semi-conscious children (with an effective gag reflex) but should be avoided in the setting of possible base of skull fracture or coagulopathy.

Initial appropriate sizes of devices may be estimated by placing the airways concave surface down along the face and using the following guidance:

- OPA size is measured as the approximate distance from the centre of the mouth to the angle of the mandible (jaw) (Figure 5).
- NPA size is measured as the approximate distance from the tip of the nose to the tragus of the ear (Figure 6).

The diameter of a NPA should approximate that of an ETT suitable for the child's age.





**Figure 5: Sizing of oropharyngeal airway**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]





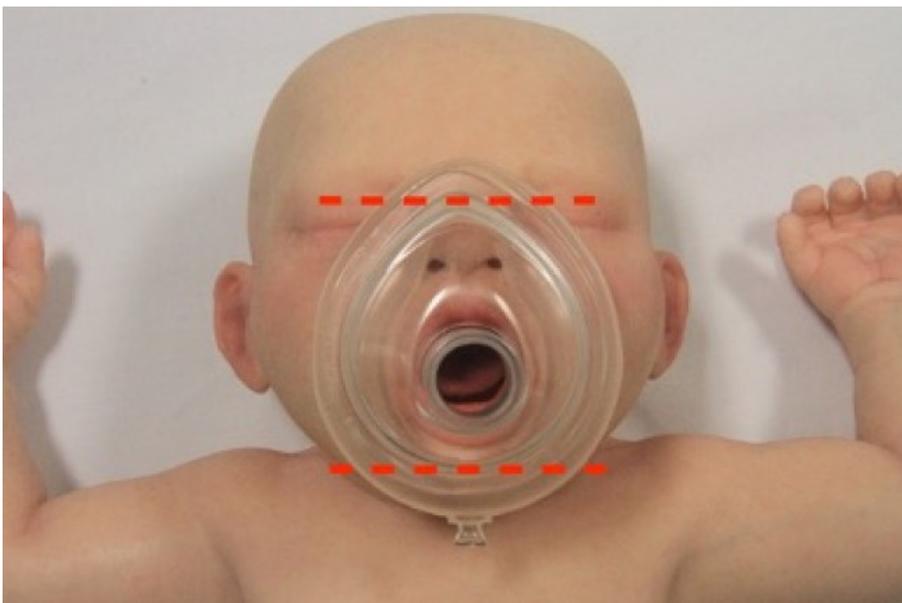
**Figure 6: Sizing of nasopharyngeal airway**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]

## 8.5 | Facemasks

A range of mask sizes should be available to administer oxygen and/or ventilation.

The correctly sized facemask extends from the bridge of the nose to the space between the lower lip and point of the chin. Masks with inflatable or cushioned rims are preferable as they facilitate the achievement of an airtight seal between the mask and the face.



**Figure 7: Appropriate mask size in a child**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]

## 9.0 | Breathing

### 9.1 | Ventilations in paediatric resuscitation

If spontaneous ventilation is not immediately resumed after airway repositioning, ventilation should be commenced. Mechanical ventilation may be delivered by an oxygen inflated ventilation circuit (e.g. Ayre's T-piece circuit), a self-inflating bag or an operator powered resuscitator dependent on an oxygen supply. The inspiratory time should be approximately one second.

Despite the move towards chest compression only CPR to improve bystander CPR rates in untrained rescuers, most paediatric cardiac arrests are asphyxial in origin, so effective CPR (with optimised neurological outcome) requires ventilation in addition to chest compressions.<sup>18</sup>

A systematic review performed as part of the ILCOR 2025 process<sup>1</sup> found that there was insufficient evidence to support a treatment recommendation regarding the optimal order of commencing CPR in children (i.e. providing rescue ventilations or compressions first).

ANZCOR suggest that rescuers provide ventilations and chest compressions for paediatric in-hospital cardiac arrest (IHCA) and out-of-hospital cardiac arrest (OHCA) [CoSTR 2017, EvUp 2022, weak recommendation, low-certainty evidence].

ANZCOR suggest that external cardiac compression should be started while rescuers wait for a BMV device to arrive. If a BMV device is immediately available, 2 initial ventilations should be provided before commencement of external cardiac compression [ANZCOR Good Practice Statement].

### 9.2 | Advanced airway interventions in paediatric cardiac arrest

The management of the airway is central in paediatric resuscitation, particularly because respiratory conditions are a frequent cause of paediatric cardiac arrest. Positive pressure ventilation during cardiorespiratory arrest may be given by either BMV, SGA device or via an ETT, depending on the training and expertise of the rescuers. Placement of an advanced airway device, such as an SGA or ETT, may facilitate more effective resuscitation than BMV but requires more skilled personnel and the time taken to perform the procedure may interfere with other vital components of resuscitation.

The aim is to provide effective (but not excessive) ventilation with the delivery of continuous chest compressions. Challenges that may affect the quality of CPR provided if ETT/SGA insertion is attempted include:

- The procedure resulted in prolonged interruptions in chest compressions.
- Risks of failed intubation attempts and unrecognised oesophageal intubation.

The ILCOR PLS Task Force performed a systematic review in 2025 to identify and analyse all published evidence reporting outcomes of advanced airway placement during CPR in infants and children during OHCA and IHCA.<sup>1,33</sup> They found no supporting evidence that an advanced airway (SGA or ETT) during CPR improves survival or survival with a good neurological outcome after paediatric cardiac arrest in any setting when compared with BMV. Effective BMV and insertion of ETT or SGA are all difficult skills that require effective initial training, retraining, and quality control to be performed consistently, safely, and effectively.

The benefit or harm associated with advanced airway-based resuscitation may differ across settings, and available data does not help us to decide whether better outcomes might be achieved by advanced airway-based strategies by highly trained and experienced airway operators, during long distance transport, or in prolonged resuscitation situations. The analysed data are also relevant only to advanced airway interventions during CPR and do not pertain to airway management after ROSC or in other critical situations.

ANZCOR suggest the use of BMV rather than ETT or SGA insertion in the management of children during cardiac arrest in the out-of-hospital setting [CoSTR 2025, weak recommendation, very low-certainty of evidence].

The main goal of cardiopulmonary resuscitation is effective ventilation and oxygenation, by whatever means, without compromising the quality of chest compressions.

ANZCOR suggest that clinicians consider transitioning to an advanced airway intervention (SGA or ETT) when the team has sufficient expertise, resources, and equipment to allow SGA/ETT placement to occur with minimal interruptions to chest compressions or when BMV is not providing adequate oxygenation/ventilation [ANZCOR Good Practice Statement].

### 9.3 | Bag-Mask Ventilation (BMV)

Adequate inflation of the lungs is usually achievable with BMV but this can be a difficult technique for the non-expert. BMV is an acceptable technique during CPR as long as the lungs can be inflated adequately.

BMV may be delivered by either self-inflating resuscitation bags or oxygen flow-inflating (exemplified by Jackson-Rees modified Ayre's T-piece) bags. Self-inflating resuscitation bags are recommended for the occasional resuscitator because of ease of operation. High-flow oxygen should be added.

### 9.4 | Supraglottic airway (SGA)

An SGA may be used by persons trained in their use to establish an airway and give ventilation

instead of using a BMV device. They should not be used in semi-conscious patients or when the gag reflex is present. They are subject to dislodgment during transport. Their use should not replace mastery of BMV. The SGA is a suitable means of providing ventilation in situations where BMV has failed or is inadequate, and ETT intubation is not possible.

SGA sizes to suit the body weight of newborns, infants and children differ according to the SGA brand and type, so manufacturer's guidelines should be followed. It should be noted that SGA size may be better estimated using ideal rather than actual body weight.

## 9.5 | Endotracheal Intubation

Intubation of the trachea has several advantages, but should not be attempted at the disadvantage of prolonging hypoxaemia. If intubation cannot be accomplished easily, oxygenation should be re-established by assisted or controlled positive pressure ventilation with a BMV device before a re-attempt at intubation.

Endotracheal intubation offers several advantages, as it:

- Establishes and maintains a patent airway.
- Facilitates initial mechanical ventilation with 100% oxygen (and later accurate administration of lesser amounts).
- Minimises risk of pulmonary aspiration.
- Enables suctioning of the trachea.
- May be more practical for airway maintenance and ventilation than BMV during prolonged management or transport.

If insertion of an ETT meets tracheal resistance, a size 0.5 mm smaller should be tried. Cuffed tubes may be preferable when lung compliance is poor. Initial insertion of a cuffed tube obviates the need to change a tube when oxygenation is compromised by a leak around a tube that is too small.

The ILCOR 2020 PLS Task Force commissioned an evidence update comparing cuffed with uncuffed tracheal tubes<sup>15</sup> to identify any evidence on the topic published since the last review of this topic in 2010.<sup>34</sup> In view of subsequent improvements in low-pressure cuffed tube manufacturing, the PLS Task Force decided to discontinue reviewing this question in 2025.

ANZCOR suggest that cuffed tracheal tubes are used for emergency intubation of infants (>28 days and >3kg) and children. If cuffed tracheal tubes are used, avoid excessive cuff pressures [ANZCOR Good Practice Statement].

### For uncuffed tubes:

Age of child	ETT size internal diameter (mm)
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Term newborn (2000-3000g)	3.0	
Term newborn (>3kg)	3.0 – 3.5	
Infant up to 6 months	3.5	
Infant 7-12 months	4.0	
Child >1 year	Age (in years)/4 + 4	

For cuffed tubes:

Age of child	ETT size internal diameter (mm)	
Term newborn (>3kg)	3.0	
Infant up to 12 months	3.0	
Child 1-2 years	3.5	
Child >2 years	Age (in years)/4 + 3.5	

The tube should be inserted to a specified length to avoid accidental extubation or endobronchial intubation. The approximate depth of insertion measured from the centre of the teeth (or gums) for oral or nasal tubes are displayed in the following table:

Age of child	Oral ETT Approx. insertion depth (cm)	Nasal ETT Approx. insertion depth (cm)
Term newborn	9.0	11.0
Infant 6 months	11.5	13.0
Child 1 year	12.0	14.0
Child >1 year	Age (in years)/2 + 12	Age (in years)/2 + 15

Although a guide, assessment of the depth of intubation is not reliable during laryngoscopy because this is performed with the neck extended, whereas on removal of the laryngoscope, the head assumes a position of neutrality or flexion, thereby increasing the depth of insertion. Initial intubation by the nasal route should not be attempted unless the oral route is obstructed.

Intubation by the oral route is invariably quicker, less likely to cause trauma and haemorrhage, and the tube is more readily exchanged if the first choice is inappropriate. However, orally placed tubes are more likely than nasally placed tubes to dislodge or intubate a bronchus. The ETT should be secured to the face with adhesive tape.

Confirmation of correct placement should be undertaken immediately after insertion and frequently thereafter. In emergency conditions, the oesophagus or a bronchus may be mistakenly intubated. Moreover, displacement during resuscitation or transport may occur.

Successful endotracheal intubation may be indicated by:

- The tip of the tube is visualised passing through the vocal cords at intubation.
- Bilateral lung inflation on auscultation of breath sounds in the axillae.
- Observation of intermittent rise and fall of the chest observed with each ventilation.
- Return and maintenance of oxygenation.
- Exhaled carbon dioxide (CO<sub>2</sub>) detection (colorimetric detector or capnography).

ANZCOR suggest that confirmation of tracheal tube position using exhaled CO<sub>2</sub> detection (colorimetric detector or capnography) should be used for intubated infants and children with a perfusing cardiac rhythm in all settings (e.g. out-of-hospital, emergency department, intensive care unit, inpatient, operating room) [ANZCOR Good Practice Statement].

Note that CO<sub>2</sub> excretion cannot occur without pulmonary blood flow. Lack of CO<sub>2</sub> detection implies non-tracheal intubation or lack of pulmonary blood flow, possibly due to excessive ventilation or inadequate chest compression or a combination of these factors. The position of the tube in the trachea should be rechecked immediately.

A nasogastric (or orogastric) tube should be inserted to decompress the stomach, which is often inflated by mask delivered positive pressure ventilation. An over-inflated stomach may impede the ability to oxygenate and ventilate, especially in infants, and also increases the risk of vomiting.

## 9.6 | Use of cricoid pressure during intubation

The ILCOR 2020 PLS Task Force commissioned an evidence update about the use of cricoid pressure during endotracheal intubation<sup>15</sup> to identify any evidence on the topic published since the last review in 2010.<sup>34</sup> The evidence update identified 2 observational studies suggesting an association between external laryngeal manipulation, such as cricoid pressure, and increased difficulty during tracheal intubation of children in the emergency setting. The PLS Task Force retired this PICOST in 2025.

ANZCOR suggest that, if cricoid pressure is used during emergency intubation in infants and children, it should be discontinued if it impedes ventilation or interferes with the speed or ease of intubation [ANZCOR Good Practice Statement].

## 9.7 | Ventilation rate with advanced airway during cardiac arrest

The ILCOR PLS Task Force conducted a systematic review in 2024<sup>35</sup> and an evidence update in 2025<sup>1</sup> to determine if there was new evidence to support optimal minute ventilation (product of tidal volume and respiratory rate/min) after the placement of an advanced airway during CPR in infants or children.

There was no evidence identified to support any specific ventilation rate for the infant or child with inadequate ventilation and a perfusing rhythm. The evidence update did identify a small single-centre observational paper that reported an association of ventilation rates higher than 12 to 20/min with improved outcomes.<sup>36</sup> This study showed improved rates of survival with good neurological outcome and survival to hospital discharge with ventilation rates  $\geq$  30 breaths/min in infants (age <1 year) and  $\geq$  25 breaths/min in children (1 year or older).<sup>36</sup>

ANZCOR suggest that, after placement of a secure airway, ventilation rates close to age-appropriate respiratory rates should be used, with avoidance of hypoventilation and hyperventilation [ILCOR Good Practice Statement]. ANZCOR suggest a ventilation rate approximating 30 breaths/minute for infants and 25 breaths/minute for older children (>1 year) [ANZCOR Good Practice Statement].

## 10.0 | Circulation

The circulation may be assessed by looking for movement, coughing or normal breathing. Agonal respiration (gaspings, laboured breathing) describes an abnormal pattern of breathing (brainstem reflex) associated with cardiac arrest that should not be confused with normal breathing.

Pulse check accuracy was the subject of an ILCOR 2025 PLS Task Force systematic review.<sup>1,37</sup>

ANZCOR suggest that the palpation of a pulse (or its absence) is unreliable as the sole determinant of cardiac arrest and the need for chest compressions [CoSTR 2025, weak recommendation, very low certainty evidence]. In infants and children who are unresponsive and breathing is absent (or agonal), healthcare providers should begin CPR [ILCOR Good Practice Statement].

To give chest compressions, the child should be placed on a firm surface and compression directed to the lower half of the sternum.

## 10.1 | Compression depth & release

A scoping review was conducted as part of the 2020 ILCOR PLS Task Force process<sup>15</sup> to identify new evidence since the 2015 guidelines regarding paediatric chest compression depth. No new published evidence was identified with this scoping review but the PLS Task Force did identify an

ongoing large prospective observational international multicentre study on CPR quality using dual-sensor CPR feedback devices from the pediRES-Q group. While awaiting results of this study, treatment recommendations are unchanged from 2015.<sup>21</sup>

ANZCOR suggest that rescuers compress the chest by at least one third of the anteroposterior dimension, or approximately 4cm in an infant and 5cm in a child [CoSTR 2015, weak recommendation, very low-certainty evidence], and up to 5 to 6cm in an adolescent [ANZCOR Good Practice Statement].

## 10.2 | Method of compression

An evidence update was performed by the ILCOR 2020 PLS Task Force to identify available evidence about different techniques for chest compressions of infants and children since the previous review was published in 2010.

### **Infants:**

ANZCOR suggest that chest compression for an infant be performed with the two-thumb encircling technique (Figure 8) as it results in consistently greater chest compression depth and less fatigue[ANZCOR Good Practice Statement].

With this technique, the rescuer's hands encircle the chest, and the thumbs compress the sternum. Care should be taken to avoid restricting chest expansion during inspiration. There is insufficient evidence to make a recommendation for or against the need for a circumferential squeeze of the chest when performing the two-thumb encircling technique for infants.<sup>15, 16, 38</sup> In the absence of evidence supporting the best way to position the thumbs, the two-thumb encircling technique can be performed with thumbs overlapping (thumb on thumb) or with thumbs side-by-side. Whatever technique is employed, pressure over the ribs and abdominal viscera should be avoided.

ANZCOR suggest that chest compression for an infant using the heel of one hand (Figure 9) may be considered if the rescuer is unable to achieve optimal compression depth using the two-thumb encircling technique [ANZCOR Good Practice Statement].



### **Figure 8: Two-thumb encircling technique in an infant**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]



**Figure 9: One hand compression technique in an infant**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]

### **Children:**

Approximately 50% of a compression cycle should be devoted to compression of the chest and 50% to relaxation to enable full recoil of the chest wall. Incomplete relaxation at the end of compression ('leaning' on the chest) should be avoided. Pauses in chest compressions should be minimised.

ANZCOR suggest that chest compression be performed with the 'heel' of one hand (Figure 10) or the two-handed technique (Figure 11) regardless of age to achieve a compression depth of at least one third of the anterior-posterior (AP) diameter of the chest. [ANZCOR Good Practice Statement]



**Figure 10: One-handed compression technique in a child**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]



**Figure 11: Two-handed compression techniques in a child**

[Image courtesy of Children's Health Queensland, licensed under CC BY-NC 4.0]

## 10.3 | Ratios and rates of compressions and ventilations

Rescuers trained in PALS should use a compression-ventilation ratio of 15:2 for each duty cycle. There should be pauses for ventilation (BMV, SGA ventilation) to allow adequate expansion of the lungs.

Ventilation should ideally be timed to occur just after a compression. This will minimise (but not eliminate) simultaneous ventilation and chest compression. To minimise the pause for lung inflation, chest compression should be recommenced during the expiratory phase of the second inflation.

When the airway is secured with an advanced airway (ETT, SGA or tracheostomy), chest compressions should be continuous (uninterrupted by ventilation) at a rate of 100 to 120 compressions per minute. Ventilation should be given at a rate as discussed in Section 9.7. During uninterrupted chest compressions, ventilation should be delivered during the release phase of a compression.

## 11.1 | Peripheral venous access

Any pre-existing functioning venous line can be used, provided it does not contain any medication or electrolyte that caused the cardiorespiratory arrest.

## 11.2 | Intraosseous injection and infusion

Establishment of intraosseous (IO) access is quicker to achieve than intravenous (IV) access in severely dehydrated children, and fluids administered by this route stabilise vital signs as quickly as fluids given intravenously. The IO route offers safe and ready access to the circulation. The bone marrow has a rich blood supply, and injected medications are distributed as fast and attain the same plasma concentrations as those injected intravenously. All resuscitative medications and fluids may be given via the IV or IO route.<sup>24</sup> Although most commonly used for young children, the IO route can be used for patients of any age, including premature newborns and adults. Any IV fluid or medication may be administered with the aid of gravity, infused under pressure or injected from a syringe. Although many sites may be used, the antero-medial surface of the proximal tibia is the most suitable puncture site during resuscitation of infants and children.

IO needles and drills are specifically manufactured for this purpose.

Correct positioning of the IO needle, confirmed by aspiration of bone marrow or injection of 0.9% Sodium Chloride without extravasation, is necessary to avoid compartment syndrome. Bone marrow may be used reliably for venous biochemical and haematological analysis but not for venous blood gas tensions. Contraindications to IO needle insertion include previous attempt in the same bone, local trauma, infection and bone disorders.

IO medication administration was the subject of a systematic review conducted as part of the ILCOR 2020 process.<sup>15</sup> An evidence update in 2025<sup>1</sup> found no new paediatric studies were identified since the recommendation in 2010,<sup>24</sup> so our advice remains unchanged.

ANZCOR suggest that, in the setting of cardiac arrest, the intraosseous route is recommended if peripheral or central venous access is not already in place [ILCOR Good Practice Statement].

## 11.3 | Central venous cannulation

ANZCOR suggest that, if a central venous line is already in place, it should be used in preference to any other route, but central venous cannulation via the subclavian or internal jugular veins during CPR is not recommended as it wastes time and may be hazardous in this circumstance [ANZCOR Good Practice Statement].

## 12.0 | Fluid and medications

Fluids and medications are used in resuscitation to support cardiovascular physiology and organ perfusion and to ameliorate underlying pathophysiologic processes to reduce morbidity and mortality. Topics that were evaluated as part of the ILCOR 2025 CoSTR process included the use of vasopressors during cardiac arrest, timing of adrenaline administration, the use of anti-arrhythmic drugs in cardiac arrest, and the role of sodium bicarbonate and of calcium in the management of cardiorespiratory arrest.<sup>1</sup>

All IV and IO medications should be flushed with a sufficient volume of 0.9% Sodium Chloride or 5% glucose (for amiodarone). This ensures that the medications enter the circulation and prevent precipitation or inactivation, as occurs when sodium bicarbonate mixes with calcium or when sodium bicarbonate mixes with adrenaline (epinephrine).

## 12.1 | Fluids and medication doses

An evidence update was performed by the ILCOR 2020 PLS Task Force<sup>15</sup> to identify available evidence about preferred methods for calculating paediatric medication doses since the previous review was published in 2010.<sup>24</sup> The search performed for this evidence update identified multiple publications relating to paediatric weight estimation, considering many different methods of weight estimation. The PLS Task Force is currently conducting a systematic review on this topic. Until the systematic review is completed and analysed by the PLS Task Force, the 2010 treatment recommendation remains in effect.

ANZCOR suggest the following in relation to the calculation of medication and fluid doses in paediatric resuscitation [all ANZCOR Good Practice Statements]:

- Use the child's actual weight if known. If the child's weight is unknown, it is reasonable to use a body length tape or an age-based calculation to approximate ideal body weight.
- In obese patients, the initial doses of resuscitation medications should be based on ideal body weight that can be estimated from length or age-based calculation.

Subsequent doses of resuscitation medications should take into account the observed clinical effects and toxicities. It is reasonable to titrate the dose to the desired therapeutic effect, but it should not exceed the adult dose.

In practice, paediatric doses based on weight should generally not exceed the dose for an adult.

## 12.2 | Fluid therapy

If hypovolaemia is suspected as the cause of cardiorespiratory arrest, IV or IO crystalloid (e.g. 0.9% Sodium Chloride) may be used initially for resuscitation<sup>21</sup> as a bolus of 10 mL/kg. Additional boluses should be titrated against the response. Blood products should be considered early in the setting of trauma.

## 12.3 | Adrenaline (epinephrine)

Both alpha and beta effects of adrenaline (epinephrine) are useful in the management of cardiorespiratory arrest. Alpha vasoconstrictor effects divert blood to the cerebral and coronary circulation and can facilitate defibrillation, while beta effects are chronotropic and inotropic.

Adrenaline (epinephrine) is used to treat asystole, severe bradycardia, VF, pVT and PEA. The initial and any subsequent dose by the IV or IO route is 10 micrograms/kg with a maximum single dose of 1mg. It should be given every second loop (i.e. every 3 to 5 minutes) of the PALS pathway (see Section 7).

The ILCOR PLS Task Force conducted an updated systematic review on the use of adrenaline (epinephrine) in paediatric cardiac arrest in 2025.<sup>1</sup> An evidence update was also performed at that time, examining the timing of adrenaline doses.<sup>1</sup> Neither review identified paediatric RCTs on the topic, and the observational studies showed conflicting results.

In IHCA, for each of the critical outcomes (survival with good neurological outcome, survival to discharge, 24-hour survival, ROSC), there was very low-certainty evidence of benefit associated with earlier rather than later first adrenaline dose.<sup>15</sup>

Similarly, for OHCA, for each of the critical outcomes (survival to discharge, 30-day survival, survival to intensive care, ROSC), there was very low-certainty evidence of benefit associated with earlier rather than later first adrenaline dose.<sup>15</sup>

ANZCOR suggest the use of adrenaline in children for both OHCA [CoSTR 2025, weak recommendation, very low-certainty evidence] and IHCA [ILCOR Good Practice Statement].

ANZCOR suggest that the initial dose of adrenaline in paediatric patients with non-shockable cardiac arrest rhythms should be administered as early in the resuscitation as possible [CoSTR

2020, weak recommendation, very low–certainty evidence].

ANZCOR suggest that the initial dose of adrenaline in paediatric patients with shockable cardiac arrest rhythms should be administered after the second defibrillation attempt [ANZCOR Good Practice Statement].

ANZCOR suggest that, in the absence of consistent evidence regarding the optimal interval for subsequent adrenaline doses in paediatric patients with IHCA or OHCA, the current recommended practice of administration at intervals of 4 minutes (or every second loop of the PALS pathway) continues [ANZCOR Good Practice Statement].

## 12.4 | Amiodarone

Amiodarone is an antiarrhythmic medication with complex pharmacokinetics and pharmacodynamics. It may be used for shock-resistant VF and pVT.<sup>21</sup> The initial paediatric dose for shock-resistant VF and pVT is a bolus of 5mg/kg (maximum dose 300mg). Subsequent dosing should be informed by consultation with specialists with expertise in this area. In children, amiodarone can be used to successfully treat a wide range of other tachyarrhythmias, notably atrial tachycardias, (recurrent) supraventricular tachycardia, pulsatile ventricular tachycardia, junctional ectopic tachycardia and wide QRS-complex tachycardia (Refer to [ANZCOR Guideline 12.3](#)).

Previous CoSTR statements evaluating the use of antiarrhythmic medications during paediatric VF/pVT cardiac arrest have included extrapolated evidence from adult OHCA studies and case series of children with life-threatening ventricular arrhythmias but not cardiac arrest. Both the ILCOR PLS Task Force 2018 systematic review<sup>39</sup> and the subsequent evidence update in 2025<sup>1</sup> excluded evidence extrapolated from studies of adult cardiac arrest. A single observational cohort study with 302 patients was available for analysis. For the critical outcome of survival to hospital discharge, the study found no difference in effect for lidocaine (lignocaine) compared with amiodarone.<sup>21</sup>

ANZCOR suggest that amiodarone or lidocaine (lignocaine) may be used for the treatment of paediatric shock-resistant VF or pVT [CoSTR 2025, weak recommendation, very low-certainty evidence].

ANZCOR suggest that amiodarone be used as the standard antiarrhythmic medication for use in paediatric shock-resistant VF and pVT. Lignocaine may be used as an alternative if amiodarone is not available. [ANZCOR Good Practice Statement].

## 12.5 | Lidocaine (lignocaine)

Although lidocaine (lignocaine) has a membrane stabilising effect and a potential to aid

defibrillation, it may increase the defibrillation threshold. The dose of lidocaine (lignocaine) is 1 mg/kg IV or IO.

A comparison of lidocaine (lignocaine) and amiodarone was performed as part of the 2018 ILCOR CoSTR process (Refer to section 13.4 above on Amiodarone).

ANZCOR suggest that amiodarone or lidocaine (lignocaine) may be used for the treatment of paediatric shock-resistant VF or pVT [CoSTR 2025, weak recommendation, very low-certainty evidence].

ANZCOR suggest that amiodarone be used as the standard antiarrhythmic medication for use in paediatric shock-resistant VF and pVT. Lignocaine may be used as an alternative if amiodarone is not available. [ANZCOR Good Practice Statement].

## 12.6 | Sodium bicarbonate

Sodium bicarbonate has a limited and unproven place in the management of paediatric cardiorespiratory arrest. Administration of IV or IO sodium bicarbonate neutralises hydrogen ions in the blood but, in doing so produces carbon dioxide, which may re-enter cells to exacerbate intracellular acidosis. Other deleterious effects include hypernatremia and hyperosmolality, which may depress myocardial function. The most effective treatment for acidemia in cardiac arrest is high-quality CPR.

An evidence update performed in 2025 by the ILCOR PLS Taskforce<sup>1</sup> identified two new studies on this topic, both finding that sodium bicarbonate administration during paediatric cardiac arrest was associated with a significantly decreased rate of survival to hospital discharge.

A systematic review performed in 2025 by the ILCOR PLS Task Force<sup>1</sup> examining management of children in cardiac arrest associated with hyperkalaemia, found insufficient evidence to make a treatment recommendation for or against the use of sodium bicarbonate (Refer to Section 12.10).

ANZCOR suggest that sodium bicarbonate is not used in the management of paediatric cardiac arrest. [ANZCOR Good Practice Statement].

## 13.0 | Defibrillation

Defibrillators may be either manual or automated (AED) and need to be able to deliver shocks in the range of 0.5 to 4 J/kg. Shocks may be delivered through either pads (preferred) or paddles.

Since defibrillators have stepped energy levels, the exact energy may not be available to conform to the dosage recommendations. In this case, the closest level to the dose should be selected. To deliver a shock, pads should be placed in antero-posterior positions (one over the left of the lower

sternum and the other below the left scapula). Alternatively, pads may be placed in antero-lateral positions (one in the left mid-axilla opposite the xiphoid and the other to the right of the upper sternum). Although the AP position is preferred, the AL position may be easier for lay rescuers and for larger children. Pads should not be permitted to touch to avoid bridging and ineffective delivery.

The defibrillator should be charged while chest compressions are being carried out in order to minimise interruptions to CPR.

Care should be taken to ensure that no person is touching the patient at the time of discharge. If after charging, the need for defibrillation dissipates, the charge should be disarmed ('dumped') safely.

## 13.1 | Pad Size, Type and Placement for Paediatric Defibrillation

Pads allow chest compression to continue while charging, probably permit faster resumption of chest compression after delivery of a shock, may be safer and allow easier use of an AP position which may be more efficacious than the standard AL positions of pads. Dextrocardia may be present with congenital heart disease, and the position of the pads should be altered accordingly.

A systematic review was performed by the ILCOR 2025 PLS Task Force<sup>1</sup> to explore defibrillator pad size and placement in infants and children. No paediatric studies were identified that addressed the questions of defibrillator pad size, orientation or placement. Due to the lack of direct evidence in infants and children, the PLS Task Force used the very low certainty evidence from adult studies to inform recommendations.

ANZCOR suggest that self-adhesive defibrillation pads be used in infants and children in cardiac arrest. The largest size pads that fit an infant's or child's chest without touching each other should be used [ANZCOR Good Practice Statement].

ANZCOR suggest that [all ILCOR Good Practice Statements]:

- CPR providers using an AED follow the AED specific guidance and instructions for pads placement in infants and children.
- CPR providers using manual defibrillation in infants and children, place pads in an anterior-posterior position.

## 13.2 | Energy doses for paediatric defibrillation

A systematic review was conducted as part of the ILCOR 2025 PLS CoSTR process<sup>1</sup> to examine

outcomes after initial defibrillation doses lower, higher or approximating 2J/kg. Acknowledging the very low level of certainty, the data suggested that outcomes are not significantly better or worse with the higher or lower energy doses.<sup>40</sup> The ideal energy dose for safe and effective paediatric defibrillation remains unknown but present evidence supports a dose of 2 to 4 J/kg.<sup>1</sup>

ANZCOR suggest 4 J/kg for the initial dose of unsynchronised shock for VF and pVT, followed immediately by 2 minutes of CPR without waiting to analyse the rhythm [CoSTR 2025, weak recommendation, very low-certainty evidence].

There is insufficient evidence from which to determine a dose for second and subsequent defibrillation energy doses.<sup>1</sup>

ANZCOR suggest a dose of 4J/kg (up to the recommended adult dose) for second and subsequent shocks [ANZCOR Good Practice Statement].

### 13.3 | Single or stacked shocks for paediatric defibrillation

Before 2005, guidelines recommended 3 stacked shocks for shockable rhythms because of low first-shock efficacy with monophasic waveforms and the theoretical reduction in transthoracic impedance after each shock. However, with the advent of biphasic defibrillators, which show high first-shock success and minimal transthoracic impedance reduction, the 2005 guidelines shifted to a single-shock strategy followed by immediate chest compressions.<sup>25</sup>

A systematic review was performed by the ILCOR 2025 PLS Taskforce<sup>1</sup> to identify available updated evidence in support of single compared with stacked shocks for paediatric defibrillation.

No studies comparing single versus stacked shocks in children with OHCA or IHCA with VF or pVT were identified.

ANZCOR suggest a single-shock strategy followed by immediate CPR (beginning with chest compressions) for children with OHCA or IHCA with VF or pVT [ILCOR Good Practice Statement].

### 13.4 | Automatic external defibrillation

Although a variable dose manual defibrillator is preferred, a semi-automated external defibrillator (AED) may be used for infants and children provided it is able to differentiate shockable from non-shockable rapid paediatric rhythms.

A systematic review<sup>10, 41</sup> was conducted by the ILCOR PLS Task Force in 2022 (with a subsequent evidence update in 2025<sup>1</sup>) to examine the use of AEDs for infants and children with non-traumatic OHCA. Use of an AED was associated with improved rates of survival to hospital discharge and

survival with favourable neurological outcomes for children aged 1-17 years. There was insufficient evidence to determine any difference for infants.

ANZCOR suggest that for children older than 8 years (or >25kg), a standard AED with adult pads and dose may be used [ANZCOR Good Practice Statement].

ANZCOR suggest that in children 1 to 8 years, an AED with paediatric pads and/or paediatric dose attenuation is preferred. If that is not available, a standard AED with adult pads and dose may be used [ANZCOR Good Practice Statement].

ANZCOR suggest that for the treatment of VF/pVT in infants, the recommended method of shock delivery by device is listed in order of preference below. If there is any delay in the availability of the preferred device, the device that is available should be used. The AED algorithm should have demonstrated high specificity and sensitivity for detecting shockable rhythms in infants. The order of preference is as follows [ANZCOR Good Practice Statement]:

1. Manual defibrillator
2. AED with dose attenuator
3. AED without dose attenuator

## 14.0 | Management of non-shockable rhythms

### 14.1 | Asystole or severe bradycardia

Asystole or pulseless severe bradycardia (less than 60 bpm) which is unresponsive to initial CPR should be treated with adrenaline (epinephrine) 10 mcg/kg (maximum dose 1 mg) via IV or IO routes.<sup>42</sup> Possible underlying causes should be actively sought and treated.

If after adrenaline (epinephrine) a perfusing sinus rhythm cannot be restored, the priority of management is continuous high-quality CPR with repeated adrenaline (epinephrine) every 3 to 5 minutes (Refer to Section 12.3).

### 14.2 | Pulseless Electrical Activity (PEA)

Absent pulses despite relatively normal coordinated electrical activity visible on the ECG is PEA. PEA may be due to poor intrinsic myocardial contractility or it may be secondary to a number of remediable causes (the "4Hs and 4Ts") including hypoxaemia, hypovolaemia, hypo/hyperthermia, hyperkalaemia, hypocalcaemia, severe acidosis, pericardial tamponade, tension pneumothorax, toxins or poisons or medications (including calcium channel blockers), or massive thrombotic or

gaseous pulmonary embolism.

Management of PEA includes:

- Continuous high-quality CPR.
- Administration of adrenaline (epinephrine) 10 mcg/kg (maximum dose 1 mg) IV or IO every 4 minutes (Refer to Section 12.3).
- Treatment of possible underlying causes.

Since hypovolaemia or severe acidosis are possible treatable causes, persistent PEA may be treated with IV or IO boluses crystalloid fluid (0.9% Sodium Chloride) 10 mL/kg (repeated as required after reassessment).

## 15.0 | Management of shockable rhythms

### 15.1 | Ventricular Fibrillation & pulseless Ventricular Tachycardia

Asynchronous multifocal ventricular contraction, i.e. VF produces no cardiac output. Similarly, rapid wide-QRS complex ventricular tachycardia (VT) may produce no cardiac output. The only effective treatment is DC non-synchronised cardioversion (commonly referred to as “defibrillation”), which simultaneously depolarises all contractile tissue and may allow resumption of sinus rhythm. If the onset of VF or pVT is witnessed on an ECG monitor, such as in the ICU environment, defibrillation should be attempted before any other treatment.

The ideal energy dose for safe and effective paediatric defibrillation is unknown (Refer to Section 14.2), but for the sake of simplicity:

ANZCOR suggest 4 J/kg for the initial and subsequent defibrillation doses for VF and pVT [CoSTR 2025, weak recommendation, very low-certainty evidence], followed immediately by 2 minutes of CPR without waiting to analyse the rhythm [Good Practice Statement].

Manual defibrillators are preferred in children. If a manual defibrillator is not available, it is appropriate to use an AED for children (Refer to Section 13.4I).

If after defibrillation and a further 2 minutes of CPR, a perfusing sinus rhythm cannot be restored, the priority of management is:

- Further DC shocks (4 J/kg up to recommended adult dose) every 2 minutes.
- Continuous high-quality CPR in between shocks.
- Administration of adrenaline (epinephrine) 10 mcg/kg (maximum dose 1 mg) IV or IO every 4

minutes (Refer to Section 12.3), i.e. after every second shock.

- Treatment of possible underlying causes.

Persistent or refractory VF or pVT may be treated with antiarrhythmics such as amiodarone 5 mg/kg (maximum dose 300 mg) IV or IO as a bolus (Refer to Section 12.4).

If amiodarone is unavailable as an anti-arrhythmic for DC-shock resistant VF or pVT, lidocaine (lignocaine) may be used as an alternative (Refer to

Section 12.7) in a dose of 1 mg/kg IV or IO.

## 16.0 | Monitoring and improvement of quality outcomes in resuscitation

Physiological monitoring and feedback during CPR can facilitate the adjustment of CPR delivery during resuscitation and, as a result, may improve the quality of resuscitation and even resuscitation outcomes.<sup>38</sup> Such monitoring may also allow for 'individualised CPR' tailored to the patient's needs and their responses to resuscitation interventions.<sup>38</sup>

### 16.1 | Vital signs

Routine monitoring of heart rate, respiratory rate and blood pressure is essential for infants and children with critical illness. It is prudent to have ready access to or have displayed the normal age-related values for rapid reference.

### 16.2 | Oximetry

Pulse oximetry ( $SpO_2$ ) is essential monitoring in all critically ill patients. It equates well to arterial haemoglobin-oxygen saturation ( $SaO_2$ ) but not when the  $SaO_2$  is below 70%. The relationship between haemoglobin-oxygen saturation and partial pressure of oxygen in arterial blood ( $PaO_2$ ) is not linear. It should be noted that a  $SpO_2$  of 90%, although only 10% below normal haemoglobin-oxygen saturation, represents a partial pressure of oxygen in arterial blood ( $PaO_2$ ) of 60 mmHg which is 40 mmHg below normal.

### 16.3 | End-tidal CO<sub>2</sub>

End-tidal carbon dioxide (ETCO<sub>2</sub>) monitoring has been recommended to confirm tracheal tube

placement since ILCOR 2000.<sup>43</sup> In addition, ETCO<sub>2</sub> detection during positive pressure ventilation may guard against inadvertent extubation, particularly when the intubated patient undergoes transport to, within or between hospitals. Small movements of the head and neck, as may occur on transfer from one trolley to another or to a bed, may easily dislodge an endotracheal tube.

ETCO<sub>2</sub> monitoring can also offer an indirect indication of cardiac output and pulmonary blood flow (noting caveats in relation to pulmonary blood flow and ventilation: perfusion ratio or with rapid changes caused by deterioration or response to effective treatment). As a result, ETCO<sub>2</sub> has been proposed as a method to evaluate the effectiveness of CPR and to identify possible ROSC. A rapid increase in ETCO<sub>2</sub> may be associated with improved CPR (or ROSC), and a sustained decline or persistently low ETCO<sub>2</sub> may be observed in the absence of ROSC.

A scoping review was performed by the ILCOR 2020 PLS Task Force<sup>38</sup> (with a subsequent evidence update in 2025<sup>1</sup>) to examine the use of ETCO<sub>2</sub> to provide feedback to guide resuscitation efforts. Evidence was insufficient to make specific guidance. The Task Force discussed that, for children in cardiac arrest, monitoring ETCO<sub>2</sub> may help achieve quality CPR; however, specified values to guide intra-arrest interventions have not been well established.

ANZCOR suggest that ETCO<sub>2</sub> be considered as a part of cardiac arrest monitoring in infants and children to provide feedback on the quality of CPR and to help early identification of ROSC [ANZCOR Good Practice Statement].

## 16.4 | Electrocardiograph (ECG)

The ECG should be displayed with either defibrillator electrodes or pads. Medication therapy or immediate direct current shock is administered according to the existing rhythm. Electrolyte status, especially that of potassium and calcium should be checked and may be indicated by ECG patterns.

## 16.5 | Intra-arterial blood pressure monitoring during CPR

Maintenance of adequate arterial systolic (compression) and diastolic (relaxation) or mean pressure during CPR is crucial to maintain coronary and cerebral perfusion. Maintaining a sufficient minimum threshold blood pressure should be associated with improved clinical outcomes.<sup>38</sup> It is unknown if CPR directed to meet individualised rather than uniform standard blood pressure targets will improve outcomes from cardiac arrest.

A systematic review<sup>1</sup> was performed by the ILCOR 2025 PLS Task Force to identify available evidence on this topic published since the 2020 scoping review.<sup>38</sup> No randomised control trials (RCTs) were identified in the search but data was collated from very low-certainty evidence from 6 observational trials, all of which were from cohorts in the United States (ICU-RESUSCITATION, Paediatric Intensive Care Quality of CPR study, and Get With the Guidelines-Resuscitation).

For the critically important outcomes (ROSC, survival to hospital discharge, and survival with favourable neurological outcome), the review showed a benefit from exposure to diastolic blood pressure (DBP) of  $\geq 25$  mm Hg for infants and  $\geq 30$  mm Hg for children for the first 10 minutes of CPR, for paediatric patients with IHCA and invasive arterial blood pressure monitoring in place at the time of arrest. No association was found between systolic blood pressures measured during CPR and neurological outcomes.

ANZCOR suggest targeting an intra-arrest diastolic blood pressure of  $\geq 25$  mmHg for infants  $< 1$  year and  $\geq 30$  mmHg for children 1 to 18 years when invasive blood pressure monitoring is in place at the time of cardiac arrest [CoSTR 2025, weak recommendation, very low-certainty evidence].

## 16.6 | Point of Care Ultrasound (POCUS)

There is very limited paediatric evidence documenting the use of ultrasonography to identify reversible causes of arrest, for prognostication, or to determine cardiac futility. In the 2020 scoping review,<sup>38</sup> the ILCOR PLS Task Force warned against rapid implementation of POCUS into paediatric practice without sufficient evidence, despite its great potential and widespread acceptance. Acquisition and interpretation of images in children is more complex, especially in children with pre-existing heart disease. Furthermore, there are significant material and training costs which might be important in low-resource settings. The ILCOR PLS Task Force performed evidence updates on this topic in 2023 and 2025<sup>1</sup> but neither identified any new paediatric studies on this topic.

ANZCOR suggest that, for children in cardiac arrest, echocardiography may be considered to identify potentially treatable conditions (4Hs and 4Ts) when appropriately skilled personnel are available, but the benefits must be carefully weighed against the known deleterious consequences of interrupting chest compressions [ILCOR Good Practice Statement].

## 16.7 | Near-infrared spectroscopy (NIRS)

Near-infrared spectroscopy (NIRS) is a non-invasive mode of estimating regional cerebral and renal/mesenteric oxygen saturation ( $rSO_2$ ) and can detect these signals in no blood flow situations as in cardiorespiratory arrest. Cerebral NIRS values can reflect cerebral physiological changes (i.e. intracranial tissue oxygenation that can be affected by arterial blood flow, tissue perfusion, and venous drainage) during cardiac arrest, during changes in intracranial pressure, during arrest resolution, and after ROSC.

A scoping review was performed as part of the 2020 ILCOR PLS CoSTR process<sup>38</sup> and an evidence update was performed in 2025.

The evidence update<sup>1</sup> identified a single-centre observational study utilising data from 3 hospitals in

the Paediatric Resuscitation Quality Collaborative, which showed that median cerebral regional oxygen saturation measured with cerebral NIRS during IHCA in children was associated with increased rates of ROSC and survival to hospital discharge.

At present, there is no consensus on a cut-off threshold of regional cerebral oxygen saturation [rSO<sub>2</sub>] that can be used as an indicator of futility, nor is there a single rSO<sub>2</sub> value that can be used as a target during CPR or an argument to continue CPR. Adult literature suggests that a trend in rSO<sub>2</sub> is the most useful prognostic indicator, although this has not yet been validated in adults or children. Evidence is currently insufficient for ANZCOR to make a recommendation about use of NIRS in children.

## 16.8 | Feedback Devices

CPR feedback or prompt devices are intended to improve CPR quality, probability of ROSC, and survival from cardiac arrest.<sup>38</sup> Feedback devices involve technology that can measure various aspects of CPR mechanics, including ventilation rate, chest compression mechanics (e.g. depth, rate, recoil), and measures of flow time (CPR fraction, pre- and post-shock pauses). Data can be presented to the provider in real time and/or provided in a summary report at the end of a resuscitation.<sup>38</sup>

Feedback devices have been shown to improve CPR performance in the training setting.<sup>44</sup> A systematic review on this topic (including adults and children with cardiac arrest) was performed as part of the 2020 ILCOR BLS Task Force CoSTR process<sup>45</sup> and a broader scoping review was performed in 2025.<sup>46</sup>

ANZCOR suggest the use of real-time audiovisual feedback and prompt devices during CPR in clinical practice as part of a comprehensive quality improvement program for cardiac arrest designed to ensure high-quality CPR delivery and resuscitation care [CoSTR 2025, weak recommendation, very low-certainty evidence].

## 17.0 | Checking of resuscitation equipment

ANZCOR guidelines should be considered in conjunction with accepted National Standards and local policies.

The checking and maintenance of hospital and resuscitation equipment is covered by National Standards and local policies. Practitioners involved in resuscitation should always be alert to errors of assembly or use and have checking processes to minimise these risks before equipment is used. They should also respond to unexpected situations with further checking procedures. In the case of unexplained hypoxia, this may include changing gas supply and circuits, removing the patient from ventilators and gas supplies, and using a self-inflating bag with room air.

## 18.0 | Family presence during resuscitation

Current literature supports that family presence during a paediatric resuscitation does not adversely affect survival, nor does it impede the performance of the resuscitation team.

The ILCOR EIT Task Force performed a systematic review on this topic in 2022 and an evidence update in 2025.<sup>47</sup>

Most studies have reported that family presence during the trauma or cardiac resuscitation of a paediatric family member did not have detrimental emotional or psychological impacts and that being present at the resuscitation was associated with improved measures of coping and positive emotional outcomes (Refer to [ANZCOR Guideline 10.6](#)).

Family members should be kept closely informed of events. They should be provided the opportunity (but not coerced) to be present at the resuscitation of their child. A staff member should be assigned to be with them and support them during the process. If family presence is negatively affecting the performance of the resuscitation by healthcare personnel, the family may be asked (in a sensitive manner) to leave. If resuscitation is unsuccessful or treatment is withdrawn or withheld, parents should be given the opportunity to be with their deceased child after equipment has been removed. If a coronial enquiry is necessary, removal of devices may require permission from a coroner. Follow-up discussion should be routinely offered to parents.

ANZCOR suggest that family members be provided with the option to be present during resuscitation from cardiac arrest [EIT CoSTR 2025, weak recommendation; very low-certainty evidence].

ANZCOR suggest [all ILCOR Good Practice Statements]:

- Policies or protocols about family presence during resuscitation should be developed to guide and support health care professionals' decision-making.
- When implementing family presence procedures, healthcare providers should receive education about family presence during cardiac arrest resuscitation, including how to manage these stressful situations, family distress and their own responses to these situations.

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