Guideline 12.4 – Paediatric resuscitation in special circumstances

Summary

Search date/s	ILCOR literature search details and dates are available on the CoSTR page of the ILCOR website (https://costr.ilcor.org) and relevant CoSTR documents.
Questions/PICOs:	Are described in the CoSTR documents (https://costr.ilcor.org)
Method:	The guideline process includes involvement of stakeholders from member organisations of the Australian Resuscitation Council & 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 www.anzcor.org. 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.
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Abbreviations

Abbreviation	Meaning/Phrase
ANZCOR	Australian and New Zealand Committee on Resuscitation

CoSTR	Consensus on Science with Treatment Recommendations
CPR	cardiopulmonary resuscitation
ECG	electrocardiogram
ECLS	extracorporeal life support
ECMO	extracorporeal membrane oxygenation
ED	emergency department
IHCA	in-hospital cardiac arrest
ILCOR	International Liaison Committee on Resuscitation
IV	intravenous
IO	intraosseous
LVADs	left ventricular assist devices
PALS	paediatric advanced life support
ROSC	return of spontaneous circulation
TCA	traumatic cardiac arrest

Summary of Changes

The main changes made in this latest update to the ANZCOR Guideline 12.4 include:

Section	Updated Guidance	Previous Guidance
2.0	Added a new section on children with cardiac arrest due to hypovolaemia.	Nil
4.0	Added a new section on children with cardiac arrest due to electrolyte or metabolic disorders.	Some advice previously covered in 12.2
7.0	Added a new section on children with cardiac arrest due to pulmonary embolism.	Nil
9.0	Added new guidance on management of children with LVADs.	Nil

9.0	Added new ILCOR Good Practice Statement: In children who develop signs of pulmonary hypertensive crisis, low cardiac output, or right ventricular failure despite optimal medical therapy, extracorporeal membrane oxygenation (ECMO) may be considered before cardiac arrest or for refractory cardiac arrest as a bridge to recovery or as a bridge to the evaluation for organ replacement and transplantation in very select cases.	Nil

1.0 | Reversible causes of cardiorespiratory arrest

During CPR, the early identification and treatment of any reversible cause of cardiac arrest is a high priority for advanced life support providers. The mnemonic “4 Hs and 4 Ts” may be useful to remind rescuers of what to actively consider and correct:

- Hypoxia
- Hypovolemia
- Hypothermia or hyperthermia
- Hyper/hypokalaemia or other metabolic disorder
- Tension pneumothorax
- Tamponade (cardiac)
- Toxins
- Thrombosis (pulmonary or coronary)

The management of each of these causes is generally the same in cardiac arrest as in acute life-threatening disease.

Specific conditions such as cardiac surgery, neurosurgery, trauma, drowning, sepsis, and pulmonary hypertension also require a specific approach. The more widespread use of ECMO in life support has significantly changed the concept of ‘reversibility’ following cardiac arrest.

ANZCOR suggests staff in hospitals performing cardiothoracic surgery in children should establish

institution-specific algorithms for cardiac arrest after cardiothoracic surgery [ANZCOR Good Practice Statement].

2.0 | Hypovolaemia

If hypovolaemia is suspected as the cause of cardiorespiratory arrest, intravenous or intraosseous crystalloid (e.g. 0.9% Sodium Chloride) may be used initially for resuscitation[21] as a bolus of 10 mL/kg. Additional boluses should be titrated against the response.

3.0 | Children with hypothermic cardiac arrest

Cardiac arrest caused by hypothermia is rare in Australia and New Zealand. The chance of survival with good neurological outcome in children after hypothermic arrest is difficult to estimate. Evidence suggests a worse prognosis for children with preceding or associated asphyxia. The mechanism and circumstances of the hypothermia and the first measured core body temperature (<24 ^{0}C is more likely primary hypothermia) should be considered.

The standard paediatric advanced life support (PALS) actions should be adapted to adjust for the hypothermic state.

ANZCOR suggests for hypothermic cardiac arrest in children follow the standard PALS algorithm with the following modifications [all ANZCOR Good Practice Statements]:

- Core temperature < 30 ^{0}C
  - Administer no medications until core temperature is >30 ^{0}C.
  - Provide a maximum of 3 shocks if a shockable rhythm is identified.
  - If defibrillation attempts are unsuccessful, delay further shocks until core temperature is >30 ^{0}C.
- Core temperature 30 to 35 ^{0}C
- Follow standard PALS algorithm.
  - Consider modifying adrenaline interval to 8 minutes.
- Core temperature > 35 ^{0}C
  - Follow standard PALS algorithm.

4.0 | Children with cardiac arrest due to electrolyte or metabolic disorders

4.1 | Hyperkalaemia

A systematic review was performed in 2025 by the ILCOR PLS Taskforce[1] examining management of children in cardiac arrest associated with hyperkalaemia.

Therapies which rapidly decrease serum potassium level (for management of hyperkalaemia) include:

- Intravenous (IV) glucose PLUS insulin push over 3 to 5 minutes in cardiac arrest
- IV salbutamol bolus or infusion
- a combination of these agents (insulin PLUS glucose PLUS salbutamol)

Although the routine use of calcium for infants and children with cardiorespiratory arrest is not recommended (see 4.3), it may be considered in specific circumstances, e.g. hyperkalaemia.

ANZCOR suggests using intravenous salbutamol or insulin with glucose (or a combination of both) to lower the potassium levels in paediatric patients with cardiac arrest associated with hyperkalaemia, with the aim to lower the potassium levels in paediatric patients with cardiac arrest associated with hyperkalaemia. This should be performed concurrently with ongoing high-quality resuscitation efforts [ILCOR Good Practice Statement].

4.2 | Hypokalaemia

Hypokalaemia may cause a life-threatening tachyarrhythmia. Emergency treatment is the IV or intraosseous (IO) administration of KCl.

Extreme caution in the use of concentrated solutions of potassium is advised. Infusions should only be given by infusion pumps and frequent (every 30 to 60 minutes) serum monitoring with continuous electrocardiogram (ECG) monitoring, preferably in an intensive care unit setting. Mistakes in the calculation of potassium requirement and inadvertent administration of potassium may cause avoidable deaths.

4.3 | Calcium in cardiac arrest

Calcium may be used as an inotropic or vasopressor agent, but it has no place in the management of an arrhythmia unless it is caused by hyperkalaemia, hypocalcaemia, hypermagnesaemia or calcium channel blocker.[21]

A systematic review was performed by the ILCOR PLS Task Force in 2023[8] to identify available evidence about use of calcium in paediatric arrest. A subsequent evidence update in 2025[1]identified 2 additional observational studies in children, both of which found a significantly lower rate of sustained ROSC, lower survival rate to hospital discharge and lower survival to discharge with favourable neurologic outcome associated with use of calcium in arrest.

A systematic review performed in 2025 by the ILCOR PLS Task Force[1]examining management of children in cardiac arrest associated with hyperkalaemia, found insufficient evidence to make a treatment recommendation for or against the use of calcium.

ANZCOR suggests that routine use of calcium for infants and children with cardiorespiratory arrest is not recommended in the absence of hypocalcaemia, calcium channel blocker overdose, hypermagnesemia, or hyperkalaemia [ANZCOR Good Practice Statement].

Calcium chloride is more potent but is irritating to veins so should be administered via IO or a central venous line. Calcium gluconate is less irritating but requires a higher volume.

4.4 | Hypoglycaemia

Hypoglycaemia may be present in paediatric critical illness, particularly in infants. Hyperglycaemia also occurs in paediatric critical illness and is associated with increased mortality, but it is not known if this is the cause. Normal blood glucose level is 3 to 8 mmol/L.

The blood glucose level should be checked during cardiopulmonary resuscitation (CPR) and after return of spontaneous circulation (ROSC) with the aim of ensuring normoglycaemia (Refer to ANZCOR Guideline 12.5). Hypoglycaemia may be treated with 2mL/kg 10% glucose by rapid IV or IO infusion. Avoid extravasation, especially from peripheral veins, and avoid overdosage.

4.5 | Hypomagnesaemia

Hypomagnesaemia may cause life-threatening ventricular tachyarrhythmia, particularly when associated with hypokalaemia. Magnesium is the preferred antiarrhythmic treatment for polymorphic ventricular tachycardia (Torsade de pointes – “Twisting of peaks”) due to acquired or congenital prolonged QT interval syndromes.[25] Management in cardiac arrest includes IV or IO bolus dose of magnesium (magnesium sulfate).

5.0 | Traumatic cardiac arrest

Paediatric traumatic cardiac arrest (TCA) is rare but has a poor prognosis. The response to TCA is time-critical and success depends on a well-established chain of survival, including advanced prehospital and specialised trauma centre care.

The ILCOR 2020 PLS Task Force performed an evidence update on the topic of resuscitation after TCA[26] to identify any evidence on the topic published since the last review in 2010.[24] There was insufficient evidence to make a recommendation for modification of standard resuscitation for infants and children experiencing cardiac arrest due to major trauma.

Given the poor prognosis of paediatric TCA with standard care, greater prioritisation of management of some of the reversible causes is suggested in traumatic arrest e.g. treatment of assumed reversible causes should be given a higher priority to attaching a defibrillator and administration of adrenaline. CPR should be performed simultaneously with other interventions where possible, depending on available personnel. Rescuers should minimise spinal movement as far as possible without hampering the process of resuscitation.

Shockable rhythms are rare in paediatric TCA. Massive haemorrhage is a common cause of TCA. The initial treatment for external massive bleeding is direct pressure (if possible, using haemostatic dressings). Depending on the site, external bleeding may be appropriately managed with application of a tourniquet.

Emergency thoracotomy in paediatric TCA patients with penetrating trauma should be considered as this may improve survival. Current evidence shows no benefit (or even worse outcome) of thoracotomy in children after blunt trauma and this intervention is not generally recommended.[27]

Children with TCA should preferably be transported directly to a major trauma centre designated for children based on the local trauma system [ANZCOR Good Practice Statement].

ANZCOR suggests the following in relation to paediatric traumatic cardiac arrest [all ANZCOR Good Practice Statements]:

· Rescuers should commence CPR while prioritising the search for and correction of any of the reversible causes of paediatric TCA.

· External exsanguinating haemorrhage should be controlled using direct pressure +/- tourniquets.

· Fluid resuscitation should occur with blood products as soon as available.

· Bilateral finger or tube thoracostomy (or needle thoracocentesis) should be considered.

· Emergency thoracotomy may be considered in paediatric TCA patients with penetrating trauma with or without signs of life on arrival to the emergency department (ED).

6.0 | Children with cardiac arrest secondary to toxic ingestions

Poisoning very rarely causes cardiac arrest in children.

Expert toxicological help should be sought for specific management of intoxications with high-risk medications (beta-blockers, tricyclic antidepressants, calcium channel blockers, digoxin or insulin).

The National Poisons Centre may be contacted for specific advice (available 24 hours):

- Australian Poisons Information Centre call 13 11 26.
- New Zealand Poisons Centre call 0800 764 766 (0800 POISON).

Drug-induced hypotension usually responds to IV fluids. Specific therapies (e.g., antidotes) may be used, where available, in addition to standard PALS algorithms.

7.0 | Children with cardiac arrest due to pulmonary embolism

Pulmonary embolism (PE) is a rare and potentially treatable cause of cardiac arrest in children and adolescents.

The ILCOR PLS Task Force performed a systematic review in 2025 to define whatspecific interventions other than standard CPR may improve clinical outcomes in paediatric in-hospital cardiac arrest (IHCA) due to suspected aortopulmonary shunt/stent obstruction.[1]

No paediatric studies were identified that directly compared standard cardiac arrest care with any specific alteration in the treatment algorithm due to confirmed or suspected PE so standard management algorithms should be followed.

8.0 | Cardiac arrest in children with sepsis

Severe sepsis and septic shock are known risk factors for paediatric cardiac arrest. Early management of suspected sepsis in children is vital as IHCA associated with sepsis has a poor outcome. The management of cardiac arrest in children with sepsis should follow the standard PALS algorithm. Early consideration and correction of possible reversible causes is a priority. Children with refractory septic shock may benefit from extracorporeal life support (ECLS) using ECMO.[27]

9.0 | Children with congenital cardiac disease

Infants and children with repaired or unrepaired congenital heart disease may require special considerations during resuscitation. However, standard CPR techniques should be used initially pending advice from a specialist centre [ANZCOR Good Practice Statement].

The ILCOR PLS Task Force performed a scoping review in 2024 followed by an Evidence Update in 2025 to examine management of children with pulmonary hypertension at high risk of pulmonary hypertensive crises with a cardiac arrest in the in-hospital setting.[1]Standard PALS techniques may be ineffective in cardiac arrest in children with pulmonary hypertension. In this setting, reversible causes of increased pulmonary vascular resistance (cessation of usual medication, hypoxia, hypercarbia, cardiac arrythmias, cardiac tamponade, drug toxicity) should be sought and treated. Treatment with pulmonary vasodilators should be considered in combination with CPR.

ANZCOR suggests that, in children who develop signs of pulmonary hypertensive crisis, low cardiac output, or right ventricular failure despite optimal medical therapy, extracorporeal membrane oxygenation (ECMO) may be considered before cardiac arrest or for refractory cardiac arrest as a bridge to recovery or as a bridge to the evaluation for organ replacement and transplantation in very select cases [ILCOR Good Practice Statement].

Aortopulmonary shunts and/or patent ductus arteriosus stents are important tools for the palliation of patients with congenital heart disease.

The ILCOR PLS Task Force performed a systematic review in 2025 to define what specific interventions other than standard CPR may improve clinical outcomes in paediatric IHCA due to suspected aortopulmonary shunt/stent obstruction.[1] No evidence was identified, and therefore no treatment recommendations other than following standard resuscitation recommendations could be made.

Recently, there has been an increasing prevalence of durable mechanical circulatory supported devices, particularly left ventricular assist devices (LVADs) and the optimal approach to identification and resuscitation of patients with acutely impaired perfusion supported by durable mechanical circulatory supported devices is controversial.

The ILCOR PLS Task Force performed a scoping review in 2025 to identify and analyse all published evidence on this subject.[1, 28]

When caring for patients with durable mechanical circulatory support who suffer acutely impaired perfusion as a result of cardiac arrest, ANZCOR suggests initiating chest compressions while simultaneously assessing for device-related reversible causes of acutely impaired perfusion [ILCOR Good Practice Statement].

10.0 | Extracorporeal Life-Support (ECLS)

Institution of extracorporeal life support (ECLS) or extracorporeal membrane oxygenation (ECMO) during cardiopulmonary resuscitation, may be considered for infants and children in hospitals that have the expertise, resources and systems to optimise the use of ECMO during and after resuscitation.

A systematic review on ECLS for paediatric cardiac arrest was performed in 2023[8] by the ILCOR Paediatric Task Force with an Evidence Update published in 2025.[1]

For the critical outcomes of favourable neurological outcome at hospital discharge and survival to hospital discharge, the limited number of studies with paediatric populations showed improved outcomes with ECLS compared to conventional CPR.

ANZCOR suggests that ECLS be considered as an intervention for selected infants and children with IHCA refractory to conventional CPR in hospitals with appropriate expertise and resources and where resuscitation systems allow ECLS to be performed well with active quality improvement systems [CoSTR 2023, weak recommendation, very low-certainty of evidence].

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