INTRODUCTION

Most of the changes in paediatric guidelines for 2005 have been made for simplification and to minimize differences between adult and paediatric protocols.

Age definitions:

- an infant is a child under one year old
- a child is between one year and puberty.

These guidelines are not intended to apply to the resuscitation of newborn (***refer to neonatal resuscitation guideline***).

SEQUENCE OF ACTIONS

1. Establish basic life support

2. Oxygenate, ventilate, and start chest compression:

Provide positive pressure ventilation with high inspired oxygen concentration.

Provide ventilation initially by bag and mask. Ensure a patent airway by using an airway manoeuvre as described in the ***child basic life support guideline.***

Provide compressions and ventilation in ratio of 15 compressions to 2 ventilations. The compression rate should be 100 per minute and the ventilation rate about 10 per minute.

In most circumstances, tracheal intubation should be avoided in children. The technique is difficult and used only rarely; the skill is very difficult to acquire and maintain. The position of the tube cannot always be verified outside hospital, tubes are often misplaced, on-scene times are extended, fixation of the small tubes is difficult and they often become displaced during the subsequent journey. Intubation should be considered only when the journey to hospital is likely to be prolonged or where there is an appreciable risk of aspiration (for example after drowning).

Compressions should be continuous when the trachea is intubated. Take care to ensure that ventilation remains effective.

3. Attach a defibrillator or monitor:

Assess and monitor the cardiac rhythm.

If using a defibrillator, place one defibrillator pad or paddle on the chest wall just below the right clavicle, and one in the left anterior axillary line.

Pads or paddles for children should be 8-12cms in size, and for infants should be 4.5cms. If larger pads or paddles only are available, then for infants it may be more appropriate to apply the pads or paddles to the front and back of the chest.

Place monitoring electrodes in the conventional positions.

4. Assess rhythm and check for signs of circulation:

Look for signs of circulation. These include responsiveness, coughing, and normal breathing.

Check the pulse:

- child – feel for the carotid pulse in the neck
- infant – feel for the brachial pulse on the inner aspect of the upper arm.

Take no more than 10 seconds for the pulse check

Assess the rhythm on the monitor:

- non ventricular fibrillation VF/non-ventricular tachycardia VT (asystole or pulseless electrical activity)
- VF/pulseless VT.

5. Non-shockable (asystole, pulseless electrical activity - PEA)

This is the more common finding in children.

Perform continuous CPR:

- ventilate with high concentration oxygen
- if ventilating with bag-mask give 15 chest compressions to 2 ventilations for all ages
- if the patient is intubated, chest compressions can be continuous as long as this does not interfere with satisfactory ventilation
- the compression rate should be 100 per minute and the ventilation rate about 10 per minute.

NOTE: Once there is return of spontaneous circulation (ROSC) the ventilation rate should be 12–20 per minute. Measurement of exhaled CO_2 should be used if possible to ensure correct tracheal tube placement if the child has been intubated.

Administer adrenaline:

- obtain circulatory access. Insert a peripheral venous cannula or an intraossous needle. Do not delay finding a vein – if in doubt use the intraosseous route

- once circulatory access has been established, give adrenaline 10 micrograms/kg (0.1mls/kg of 1 in 10,000 solution)
- given a lack of evidence for the effectiveness of adrenaline given by the ET route, this route of administration is no longer recommended.

Continue CPR

Repeat the cycle:

Give 10 micrograms/kg of **adrenaline** (***refer to adrenaline for further information***) every 3 to 5 minutes (i.e. every other loop), while continuing to maintain effective chest compression and ventilation without interruption. The dose should be 10 micrograms/kg for all subsequent doses, i.e. high dose adrenaline should not be used.

If the airway is protected by tracheal intubation, provide chest compressions without pausing for ventilation. Provide a ventilation rate of approximately 10 per minute and a compression rate of 100/minute.

When circulation is restored, ventilate the child at a rate of 12 to 20 breaths per minute.

Consider and correct reversible causes: 4Hs 4Ts

1. **H**ypoxia
2. **H**ypovolaemia
3. **H**yper/hypocalaemia
4. **H**ypothermia

1. **T**ension pneumothorax
2. **T**amponade
3. **T**oxic/therapeutic disturbance
4. **T**hromboembolism

5. Shockable (VF/Pulseless VT)

This is less common in paediatric practice but likely when there has been a witnessed and sudden collapse. It is commoner in children with heart disease.

Defibrillate the heart:

- give 1 shock of 4 Joules/kg if using a manual defibrillator
- if using an AED, in a child under the age of 8 years use paediatric attenuation (according to the manufacturer's instructions) whenever possible use the adult shock energy (150-200 Joules biphasic; 360 monophasic)
- if using an AED in a child over the age 8 years use the adult shock energy.

Resume CPR:

- without re-assessing the rhythm or feeling for a pulse resume CPR **immediately**, starting with chest compressions.

Continue CPR for 2 minutes:

Then pause briefly to check the monitor

If still VF/pulseless VT give a second shock at 4 Joules/kg if using a manual defibrillator **OR** the adult shock energy for a child over 8 years using an AED **OR** a paediatric attenuated adult shock energy for a child between 1 year and 8 years

Resume CPR immediately after the second shock.

Consider and treat reversible causes (see above: 4Hs and 4Ts).

Continue CPR for 2 minutes:

Pause briefly to check the monitor:

If still VF/ pulseless VT:

- give adrenaline 10 micrograms/kg followed immediately by a third shock
- resume CPR immediately and continue for another 2 minutes.

Pause briefly to check the monitor

If still VF / pulseless VT

- give an intravenous or intraosseous bolus of amiodarone (***refer to amiodarone for further information***) 5 millgramsg/kg and an immediate further (4th) shock
- continue giving shocks every 2 minutes, minimising the breaks in chest compressions as much as possible
- give adrenaline before every other shock (i.e. every 3-5 minutes) until return of spontaneous circulation.

After each 2 minutes of uninterrupted CPR, pause briefly to assess the rhythm.

If still in VF/VT

- continue CPR with the shockable rhythm (VF/VT) sequence.

If asystole

- continue CPR and switch to the non-shockable (asystole / PEA) sequence as above.

If an organised rhythm appears at any time, check for a central pulse:

- If there is return of a spontaneous circulation (ROSC) continue post-resuscitation care
- If there is **NO** pulse, and there are no other signs of a circulation, give adrenaline 10 micrograms/kg and continue CPR as for the non-shockable sequence as above.

Key Points – Paediatric Advanced Life Support

- Changes in guidelines have been made for simplification and minimise the difference between adult and paediatric protocols.
- One defibrillating shock rather than three stack shocks should be used.
- The use of manual defibrillators (with suitable electrodes) simplifies the administration of the correct shock energy.
- If using an AED paediatric attenuation should be used whenever possible but an unmodified AED may be used in children older than one year.
- If an AED is the only machine available it may be used in infants under the age of one year.

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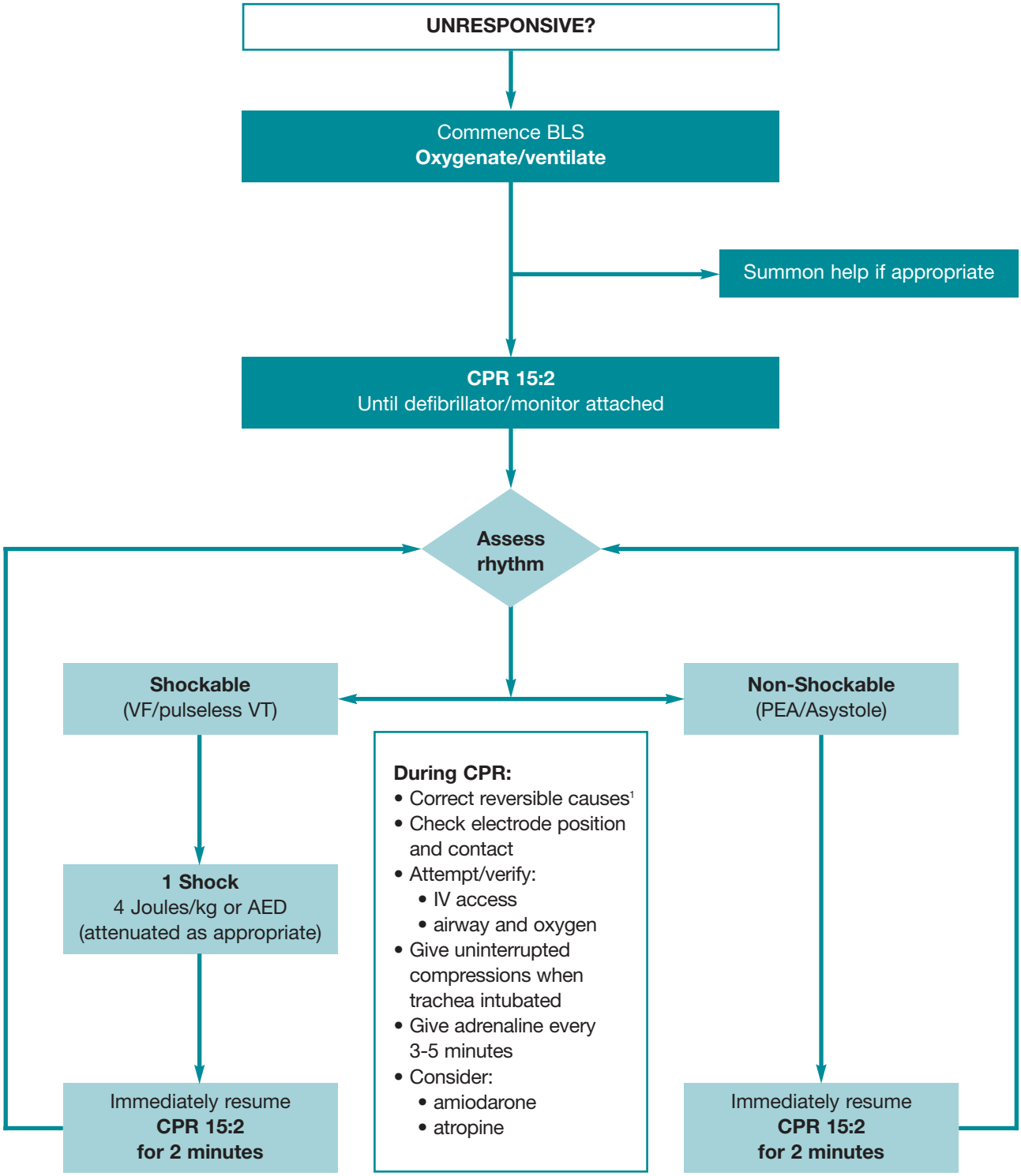
METHODOLOGY

The methodology describing the development process of the international cardio-pulmonary resuscitation treatments recommendations on which this guideline is based is fully described in the publications listed below.

Zaritsky A, Morley PT. The Evidence Evaluation Process for the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Circulation* 2005;112(22_suppl):III-128-130.

APPENDIX 1 – Paediatric Advanced Life Support Algorithm



[1]Reversible Causes

Hypoxia	Tension pneumothorax
Hypovolaemia	Tamponade, cardiac
Hypo/hyperkalaemia/metabolic	Toxins
Hypothermia	Thrombosis (coronary or pulmonary)