



European Resuscitation Council Guidelines 2000 for Basic Paediatric Life Support

A statement from the Paediatric Life Support Working Group and approved by the Executive Committee of the European Resuscitation Council

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1. Introduction

The European Resuscitation Council (ERC) last issued guidelines for Paediatric Life Support (PLS) in 1998 [1]. These were based on the 'Advisory Statements' of the International Liaison Committee on Resuscitation (ILCOR) published in 1997 [2]. Following this, the American Heart Association, together with representatives from ILCOR, undertook a series of evidence based evaluations of the science of resuscitation which culminated in the publication of 'Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care' in August 2000 [3,4]. The Paediatric Life Support Working Party of the European Resuscitation Council has considered this document and the supporting scientific literature and has recommended changes to the ERC Basic PLS Guidelines. These are presented in this paper. There have been few major changes to the ERC recommended guidelines as some of the changes agreed in 'Guidelines 2000' had already been introduced into Europe subsequent to the 1998 ILCOR 'Advisory Statements' (Fig. 1).

2. Guidelines changes

The approach to changes has been to alter the

guidelines in response to convincing new scientific evidence and, where possible, to simplify the guidelines in order to assist teaching and retention.

There is a paucity of experimental evidence, both old and new, to inform the development of guidelines for paediatric resuscitation. Some alterations, therefore, have been made in response to evidence from animal work, studies in adults and to aid congruity between adult and paediatric guidelines where this was consistent with paediatric resuscitation needs.

The changes in basic life support for infants and children are as follows:

- 1. Determining cardiac arrest by means of the pulse check:** lay rescuers will no longer be taught or expected to perform a pulse check to determine cardiac arrest, although the need for a pulse check will remain for healthcare providers. Both lay rescuers and healthcare providers will be expected to seek for 'signs of a circulation'. Several studies have made it clear that both lay rescuers and health care providers are poor at determining the presence or absence of a pulse. Poor sensitivity and specificity of the pulse check make it unreliable as the sole indicator for starting chest compressions. In addition most studies have shown that even experienced healthcare providers take longer than 10 s to determine the presence or absence of the pulse [5–10].

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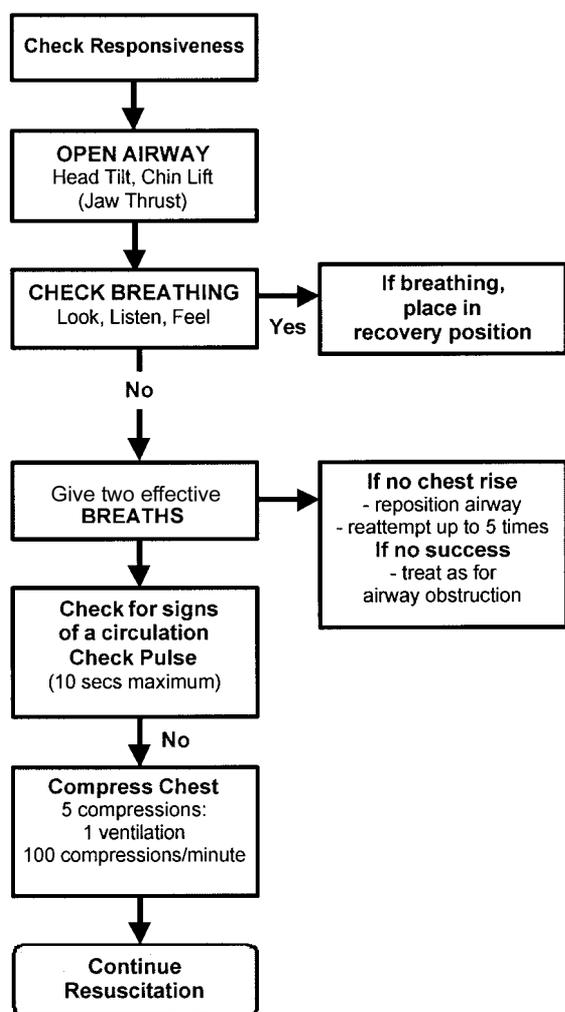


Fig. 1. Basic Paediatric Life Support.

2. Indications for starting chest compressions: chest compressions should be started in the absence of a pulse, the absence of 'signs of circulation' or if the pulse is less than 60 at all ages in association with poor perfusion. There is no experimental evidence to indicate the ideal bradycardic rate at which to start chest compressions so the rate of less than 60 with signs of poor perfusion has been chosen for all ages for ease of teaching and retention. There is evidence that 'inappropriate', properly performed chest compressions are very unlikely to cause harm to an infant or child [11,12].

3. Technique for chest compressions in the under one year old: if two or more suitably trained providers are available, a two thumb, chest encircling technique is the preferred method of chest compression in infancy. Animal experi-

ments and anecdotal reports have shown that the two thumb, chest encircling technique can produce better coronary perfusion or a higher systolic pressure during CPR than the two finger technique [13,14].

4. Compression:ventilation ratio for over 8 year olds: the CPR ratio will be 15:2 for any number of rescuers in the over 8 year old child (this mirrors the adult CPR approach). For the under 8 years olds, the CPR ratio remains at 5:1 for any number of rescuers. Although an increased number of chest compressions per sequence improves coronary perfusion [15], the 15:2 ratio decreases the amount of ventilation provided compared to the 5:1 ratio. Respiratory causes of cardiac arrest are especially important in children. In addition, in view of their small size and the need for only one hand for chest compressions up to 8 years of age, more compressions and ventilations can be given to infants and small children using the 5:1 ratio so this remains the recommended ratio for this group. For larger children, however, the 15:2 ratio is used both because of ease of use for the single rescuer and to be consistent with adult guidelines.

5. Use of automated external defibrillators (AEDs): AEDs may be used in children over the age of 8 years (25 kg or over). Below this age they may be used for rhythm recognition (although in infants they may not be accurate in identifying tachyarrhythmias) but the defibrillation dose delivered cannot currently be recommended [16,17].

6. 'Phone first' for children with heart disease: although most cardiac arrests in infants and children are non-cardiac in origin, sudden collapse in an infant or child with known heart disease is likely to be arrhythmogenic in origin. Therefore rapid access to a defibrillator is more likely to be beneficial to this group of children as opposed to immediate airway and breathing support with chest compressions which is best for all other infants and children.

7. Foreign body obstruction sequence for lay providers in the unconscious infant or child: this may be simplified following further systematic review. The sequence for the conscious infant or child and the sequence for the trained healthcare provider remain unchanged.

3. Definitions

An **infant** is a child under the age of 1 year.

A **child** is aged between 1 and 8 years of age.

In the following text the masculine includes the feminine and 'child' refers to both infants and children unless specifically noted otherwise.

Children over the age of 8 years will still be subject to the same resuscitation sequence as for a younger child but may require adult techniques and ratios to attain effective chest compressions.

4. Sequence of actions

1. Ensure the safety of rescuer and child

2. Check the child's responsiveness

- Gently stimulate the child and ask loudly: Are you all right?
- Infants, and children with suspected cervical spinal injuries, should not be shaken.

3A. If the child responds by answering or moving:

- Leave the child in the position in which you find him (provided he is not in further danger).
- Check his condition and get help if needed.
- Reassess him regularly.

3B. If the child does not respond:

- Shout for help.
- Open the child's airway by tilting his head and lifting his chin.
 - If possible with the child in the position in which you find him, place your hand on the child's forehead and gently tilt his head back.
 - At the same time, with your fingertip(s) under the point of the child's chin, lift the chin to open the airway. Do not push on the soft tissues under the chin as this may block the airway.
 - If you have any difficulty in opening the airway, carefully turn the child on to his back and then open the airway as described.

Avoid head tilt if trauma (injury) to the neck is suspected.

If neck injury is suspected use only the jaw thrust method of opening the airway.

Place the first two fingers of each hand behind each side of the child's mandibles (jaw bones) and push the jaw forward.

4. Keeping the airway open, look, listen and feel for breathing by putting your face close to the child's face and looking along the chest:

- Look for chest movements
- Listen at the child's nose and mouth for breath sounds
- Feel for air movement on your cheek.
- Look, listen and feel for up to 10 s before deciding that breathing is absent.

5A. If the child is breathing:

- Turn the child on his side into the recovery position (see below)
- Check for continued breathing.

5B. If the child is not breathing:

- Carefully remove any obvious airway obstruction
- Give two rescue breaths, each of which makes the chest rise and fall. Up to five rescue breaths may be attempted, to achieve two effective ones. While performing the rescue breaths note any gag or cough response to your action. These responses or their absence will form part of your assessment of 'signs of a circulation' which will be described later.

For a child

- Ensure head tilt and chin lift.
- Pinch the soft part of his nose closed with the index finger and thumb of your hand on his forehead.
- Open his mouth a little, but maintain the chin upwards.
- Take a breath and place your lips around his mouth, making sure that you have a good seal.
- Blow steadily into his mouth over about 1–1.5 s watching for his chest to rise.
- Maintain head tilt and chin lift, take your mouth away from the victim and watch for his chest to fall as air comes out.

Take another breath and repeat this sequence up to five times until two effective breaths have been given. Effectiveness is identified by seeing that the child's chest has risen and fallen in a similar fashion to the movement produced by a normal breath.

For an infant

- Ensure a neutral position of the head and a chin lift.

- Take a breath and cover the mouth and nasal apertures of the infant with your mouth, making sure you have a good seal. If the nose and mouth cannot be covered in the older infant, the rescuer may attempt to seal only the infant's nose or mouth with his mouth (and close the lips to prevent air escape).

- Blow steadily into the infant's mouth and nose over 1–1.5 s sufficient to make the chest visibly rise.

- Maintain head tilt and chin lift, take your mouth away from the victim and watch for his chest to fall as air comes out.

- Take another breath and repeat this sequence up to five times (until two effective rescue breaths have been given).

If you have difficulty achieving an effective breath, the airway may be obstructed

- Open the child's mouth and remove any visible obstruction. Do not perform a blind finger sweep.

- Ensure that there is adequate head tilt and chin lift but also that the neck is not over extended.

- If head tilt and chin lift has not opened the airway, try the jaw thrust method.

- Make up to five attempts in all to achieve two effective breaths.

- If still unsuccessful, move on to foreign body airway obstruction sequence.

6. Assess the child's circulation

- Take *no more than 10 s* to:

- Look for signs of a circulation. This includes any movement, coughing or normal breathing (more than agonal gasps: these can be recognised as infrequent, irregular breaths).

- Check the pulse (if you are a health care provider).

Child — feel for the carotid pulse in the neck.

Infant — feel for the brachial pulse on the inner aspect of the upper arm.

7A. If you are confident that you can detect signs of a circulation within 10 s:

- Continue rescue breathing, if necessary, until the child starts breathing effectively on his own

- Turn the child on to his side (into the recovery position) if he remains unconscious.

- Re-assess the child frequently.

7B. If there are no signs of a circulation or, no pulse or a slow pulse (less than 60/min with poor perfusion) or you are not sure

- Start chest compressions.

- Combine rescue breathing and chest compressions.

For a child

- Locate and place the heel of one hand over the lower half of the sternum ensuring that you do not compress on or below the xiphisternum.

- Lift the fingers to ensure that pressure is not applied over the child's ribs.

- Position yourself vertically above the victim's chest and, with your arms straight, press down on the sternum to depress it approximately one third to one half of the depth of the child's chest.

- Release the pressure, then repeat at a rate of about 100 times a minute

- After five compressions tilt the head, lift the chin and give one effective breath.

- Return your hand immediately to the correct position on the sternum and give five further compressions

- Continue compressions and breaths in a ratio of 5:1

Note: although the rate of compressions will be 100 times a minute, the actual number delivered per minute will be less than 100 because of pauses to give breaths.

In children over the age of approximately 8 years, it may be necessary to use the 'adult' two handed method of chest compression to achieve an adequate depth of compression.

- Locate the lower half of the sternum and place the heel of one hand there, with the other hand placed on top.

- Interlock the fingers of both hands and lift them to ensure that pressure is not applied over the child's ribs.

- Position yourself vertically above the victim's chest and, with your arms straight, press down on the sternum to depress it approximately one third to one half of the depth of the child's chest.

- Release the pressure, then repeat at a rate of about 100 times a minute.

- After 15 compressions tilt the head, lift the chin and give 2 effective breaths.

- Return your hands immediately to the correct position on the sternum and give 15 further compressions.
- Continue compressions and breaths in a ratio of 15:2

For an infant

For lay rescuers and for the lone healthcare provider: the two finger method

- Locate the sternum and place the tips of two fingers, one finger's breadth below an imaginary line joining the infant's nipples.
- With the tips of two fingers, press down on the sternum to depress it approximately one third to one half of the depth of the infant's chest.
- Release the pressure, then repeat at a rate of about 100 times a minute.
- After five compressions tilt the head, lift the chin and give one effective breath.
- Return your fingers immediately to the correct position on the sternum and give five further compressions. With care, the infant's airway may be maintained in the correct position with the rescuer's free hand gently grasping the infant's bi-frontal diameter thus minimising the time for re-adjustment of airway or finger position between breathing and chest compressions.
- Continue compressions and breaths in a ratio of 5:1.

For more than one health care provider: the two thumb method

- Locate the sternum and place both thumbs flat side by side on the lower sternum with the tips pointing towards the infant's head. Place them so that the thumbs are one finger's breadth below an imaginary line joining the infant's nipples. The rest of both hands should be spread with the fingers together to encircle the lower part of the infant's rib cage with the tips of the fingers supporting the infant's back.
- Press down on the lower sternum with the two thumbs to depress it about one third to one half of the depth of the infant's chest.
- Release the pressure, then repeat at a rate of about 100 times a minute.
- After five compressions the second rescuer should tilt the head, lift the chin and give one effective breath.

- Continue compressions and breaths in a ratio of 5:1

8. Continue resuscitation until:

The child shows signs of life (spontaneous respiration, pulse, movement).

Qualified help arrives.

You become exhausted.

When to call for assistance

It is vital for rescuers to get help as quickly as possible when a child collapses.

- When more than one rescuer is available, one should start resuscitation while another rescuer goes for assistance.
- If only one rescuer is present, you should perform resuscitation for about **1 min** before going for assistance. It may be possible to take an infant or small child with you whilst summoning help and continue attempting chest compressions and ventilations.
- The only exception to performing 1 min of CPR before going for help is in the case of a child with known heart disease who collapses *suddenly*. In this case cardiac arrest is likely to be arrhythmogenic in origin and the child will need defibrillation. Help should be sought immediately.

5. Recovery position

An unconscious child whose airway is clear, and who is breathing spontaneously, should be turned on his side into the recovery position. This prevents the tongue falling back to obstruct the airway, and reduces the risk of inhalation of stomach contents. There are a number of different recovery positions, each of which has its advocates. The important principles to be followed are:

- The child should be in as near true lateral position as possible with his mouth dependant to allow free drainage of fluid.
- The position should be stable. In an infant this may require the support of a small pillow or a rolled up blanket placed behind the infant's back to maintain the position.
- Any pressure on the chest that impairs breathing should be avoided.
- It should be possible to turn the child onto his side and to return him back easily and safely, having particular regard to the possibility of cervical spine injury.

- Good observation and access to the airway should be possible.

Obstructed airway

If you have difficulty achieving an effective breath:

- Recheck the child's mouth and remove any obvious obstruction.
- Recheck that there is adequate head tilt and chin-lift but also that the neck is not over extended. Try jaw thrust.
- Make up to five attempts in all to achieve at least two effective breaths
- If still unsuccessful, move on to foreign body airway obstruction sequence.

Foreign Body Obstruction Sequence for health-care providers

There are a number of different foreign body obstruction sequences, each of which has its advocates.

If the child is breathing spontaneously his efforts to clear the obstruction should be encouraged. Intervention is necessary only if these attempts are clearly ineffective and breathing is inadequate.

- Do not perform blind finger sweeps of the mouth or upper airway as these may further impact a foreign body or cause soft tissue damage.
- Use measures intended to create a sharp increase in pressure within the chest cavity, such as an artificial cough.
- Back blows, chest thrusts and abdominal thrusts are used in children. Back blows and chest thrusts only are used in infants.

1. Perform up to FIVE back blows

- Hold the child in a prone position and try to position the head lower than the chest.
- Deliver five smart blows to the middle of the back between the shoulder blades.
- If this fails to dislodge the foreign body proceed to chest thrusts.

2. Perform up to FIVE chest thrusts

- Turn the child into a supine position and try to position the head lower than the chest.
- Give five chest thrusts to the sternum.

The position of chest thrusts is similar to that for chest compressions.

Chest thrusts should be sharper and more vigorous than compressions and carried out at a rate of about 20 per min.

3. Check mouth

After five back blows and five chest thrusts check the mouth.

Carefully remove any visible foreign bodies.

4. Open airway

Reposition the airway by the head tilt and chin lift (jaw thrust) manoeuvre.

Reassess breathing.

5A. If the child is breathing:

Turn the child on his side.

Check for continued breathing.

5B. If the child is not breathing:

Attempt up to five rescue breaths to achieve two effective breaths, each of which makes the chest rise and fall.

The child may by now have a clear airway but be apnoeic or the airway may be partially cleared, in either case the rescuer can attempt to achieve effective ventilation at this stage.

If the airway is still obstructed repeat the sequence.

For a child

- Repeat the cycle (1–5 above) but substitute five abdominal thrusts for five chest thrusts.
- Abdominal thrusts are delivered as five sharp thrusts directed upwards towards the diaphragm.
- Use the upright position if the child is conscious. Kneel behind the child or place him on a chair if one is immediately available.
- Unconscious children should be laid supine and the heel of one hand placed in the middle of the upper abdomen. Supported by the other hand, this should be sharply pushed upwards and backwards as though to the centre of the chest.
- Repeat the cycles of alternate chest thrusts and abdominal thrusts with back blows.
- Repeat the cycles until the airway is cleared and rescue breaths are effective or the child breathes spontaneously.

For an infant

- Abdominal thrusts are not recommended in infants because they may rupture the abdominal viscera.
- Perform cycles of five back blows and five chest thrusts only. Try to keep the head dependent to encourage the foreign body to move out of the airway during the attempt.
- Repeat the cycles until the airway is cleared and rescue breaths are effective or the infant breathes spontaneously.

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