INTRODUCTION

The following sequence is that followed by those with a duty to respond to paediatric emergencies (***see Appendix 1***).

MANAGEMENT

1. Safety

Ensure that you, the child and any bystanders are safe

2. Check responsiveness:

Gently stimulate the child and ask loudly ***"Are you all right?"*** **- DO NOT** shake infants, or children with suspected cervical spinal injuries.

a. If the child responds (by answering or moving):

- leave the child in the position found (provided the child is not in further danger)
- check the child's condition
- summon help if necessary
- re-assess the child regularly.

b. If the child does not respond:

- summon help if necessary
- open the child's airway by tilting the head and lifting the chin:
  - with the child in the position found, place your hand on the forehead and gently tilt the head back
  - at the same time, with your fingertip(s) under the point of the child's chin, lift the chin. Do not push on the soft tissues under the chin as this may block the airway
  - if you still have difficulty in opening the airway, try the jaw thrust method: place the first two fingers of each hand behind each side of the child's mandible (jaw bone) and push the jaw forward. Both methods may be easier if the child is turned carefully onto his back
- when there is a risk of back or neck injury, establish a clear upper airway by using jaw thrust or chin lift alone in combination with manual in-line stabilisation of the head and neck by an assistant (if available). If life threatening airway obstruction persists despite effective application of jaw thrust or chin lift, add head tilt a small amount at a time until the airway is open; establishing a patent airway takes priority over concerns about a potential back or neck injury.

3. Keeping the airway open

Look, listen and feel for normal 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 no more than 10 seconds before deciding that breathing is absent.

a. If the child IS breathing normally

- turn the child onto his side into the recovery position (see below) taking appropriate precautions if there is any chance of injury to the neck or spine
- check for continued breathing.

b. If the child is NOT breathing or is making agonal gasps (infrequent, irregular breaths):

- carefully remove any obvious airway obstruction
- turn the child carefully on to his back taking appropriate precautions if there is any chance of injury to the back or neck
- give 5 initial rescue breaths
- 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.

Rescue breaths for a child over 1 year of age:

- ensure head tilt and chin lift
- use a bag valve mask device, if available, (with a mask appropriate to the size of the child) and inflate the chest steadily over about 1–1.5 seconds watching for chest rise
- maintaining head tilt and chin lift, watch the chest fall as air comes out
- repeat this sequence 5 times. Identify effectiveness by seeing that the child's chest has risen and fallen in a similar fashion to the movement produced by a normal breath.

Rescue breaths for an infant:

- ensure a neutral position of the head and apply chin lift
- use a bag valve mask device if available (with a mask appropriate to the size of the child) and inflate the chest steadily over about 1–1.5 seconds sufficient to make the chest visibly rise

- maintain head tilt and chin lift, watch the chest fall as air comes out
- repeat this sequence 5 times.

Rescue breaths for a child over 1 year of age if no bag valve mask is available:

- ensure head tilt and chin lift
- pinch the soft part of the nose closed with the index finger and thumb, with the hand on the forehead
- open the mouth a little, but maintain the chin upwards
- take a breath and place your lips around the mouth, making sure that you have a good seal
- blow steadily into the mouth over about 1–1.5 seconds watching for chest rise
- maintain head tilt and chin lift, take your mouth away from the child and watch for his chest to fall as air comes out
- take another breath and repeat this sequence five times. Identify effectiveness by seeing that the child's chest has risen and fallen in a similar fashion to the movement produced by a normal breath.

Rescue breaths for an infant if no bag valve mask is available

- 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 seal only the infant's nose or mouth with your mouth (if the nose is used, close the lips to prevent air escape)
- blow steadily into the child's mouth and nose over 1–1.5 seconds, sufficient to make the chest visibly rise
- maintain head tilt and chin lift, take your mouth away from the child and watch for the chest to fall as air comes out
- take another breath and repeat this sequence five times.

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 5 attempts to achieve effective breaths. If still unsuccessful, move on to chest compressions.

4. Assess the child's circulation:

Take no more than 10 seconds to look for signs of a circulation. This includes any movement, coughing, or normal breathing (not agonal gasps – these are infrequent, irregular breaths) check the pulse **but ensure you take no more than 10 seconds to do this**:

- in a child over 1 year— feel for the carotid pulse in the neck
- in an infant — feel for the brachial pulse on the inner aspect of the upper arm.

a. If you are confident that you can detect signs of a circulation within 10 seconds:

- 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 taking appropriate precautions if there is any chance of injury to the neck or spine
- re-assess the child frequently.

b. 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 all children, compress the lower third of the sternum:

- to avoid compressing the upper abdomen, locate the xiphisternum by finding the angle where the lowest ribs join in the middle
- compresss the sternum one finger's breadth above this
- compressions should be sufficient to depress the sternum by approximately one-third of the depth of the chest
- release the pressure, then repeat at a rate of approximately 100 a minute
- after 15 compressions, tilt the head, lift the chin and give two effective breaths
- continue compressions and breaths in a ratio of 15:2.

Lone rescuers may use a ratio of 30:2, particularly if they are having difficulty with the transition between compression and ventilation.

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. The best method for compression varies slightly between infants and children.

Chest compressions in infants

The lone rescuer should compress the sternum with the tips of 2 fingers.

If there are 2 or more rescuers, use the encircling technique.

Place both thumbs flat side by side on the lower third of the sternum (as above) with the tips pointing towards the infant's head.

Spread the rest of both hands 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 approximately one-third of the depth of the infant's chest.

Chest compression in children over 1 year of age

Place the heel of one hand over the lower third of the sternum (as above).

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

Position yourself vertically above the child's chest and, with your arm straight, compress the sternum to depress it by approximately one-third of the depth of the chest.

In larger children or for small rescuers, this may be achieved most easily by using both hands with the fingers interlocked.

5. Continue resuscitation until:

- the child shows signs of life (spontaneous respiration, pulse, movement)
- you become exhausted.

RECOVERY POSITION

An unconscious child whose airway is clear and who is breathing spontaneously should be turned onto his side into the recovery position:

- the child should be placed in as near a true lateral position as possible with his mouth dependent 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 his back to maintain the position
- it is important to avoid any pressure on the chest that impairs breathing
- it should be possible to turn the child onto his side and to return him back easily and safely, taking into consideration the possibility of cervical spine injury
- the airway should be accessible and easily observed
- the adult recovery position is suitable for use in children.

Key Points – Paediatric Basic Life Support

- If the child is not breathing, carefully remove any obvious airway obstruction but **DO NOT** perform a blind finger sweep. Give 5 initial rescue breaths. Blow steadily into the mouth over about 1–1.5 seconds watching for chest rise.
- If there are no signs of circulation, pulse, or no or a slow pulse (<60/bpm with poor perfusion) or you are not sure start at a rate chest compressions of approximately 100 a minute.
- Continue compressions and breaths in a ratio of 15:2.

BIBLIOGRAPHY

[1] Berg RA, Hilwig RW, Kern KB, Ewy GA. "Bystander" Chest Compressions and Assisted Ventilation Independently Improve Outcome From Piglet Asphyxial Pulseless "Cardiac Arrest". *Circulation* 2000;101(14):1743-1748.

[2] Babbs CF, Nadkarni V. Optimizing chest compression to rescue ventilation ratios during one-rescuer CPR by professionals and lay persons: children are not just little adults. *Resuscitation* 2004;61(2):173.

[3] Dorph E, Wikc L, Steend PA. Effectiveness of ventilation–compression ratios 1:5 and 2:15 in simulated single rescuer paediatric resuscitation. *Resuscitation* 2002;54(3):259-264.

[4] Whyte SD, Wyllie JP. Paediatric basic life support: a practical assessment. *Resuscitation* 1999;41(2):153.

[5] Clements F, McGowan J. Finger position for chest compressions in cardiac arrest in infants. *Resuscitation* 2000;44(1):43.

[6] Stevenson AGM, McGowan J, Evans AL, Graham CA. CPR for children: one hand or two? *Resuscitation* 2005;64(2):205.

[7] Samson R, Berg R, Bingham R, PALS Task Force. Use of automated external defibrillators for children: an update. An advisory statement from the Pediatric Advanced Life Support Task Force, International Liaison Committee on Resuscitation. *Resuscitation* 2003;57(3):237-243.

[8] Berg RA, Hilwig RW, Kern KB, Babar I, Ewy GA. Simulated mouth-to-mouth ventilation and chest compressions (bystander cardio-pulmonary resuscitation) improves outcome in a swine model of pre-hospital pediatric asphyxial cardiac arrest. *Critical Care Medicine* 1999; 27(9):1893-1899.

[9] Tang W, Weil MH, Jorgenson D, Klouche K, Morgan C, Yu T, et al. Fixed-energy biphasic waveform defibrillation in a pediatric model of cardiac arrest and resuscitation. *Critical Care Medicine* 2002.;30(12):2736-2741.

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.

Morley PT, Zaritsky A. The evidence evaluation process for the 2005 International Consensus Conference on cardio-pulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Resuscitation* 2005;67(2-3):167-170.

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 Basic Life Support Algorithm