

Paediatric Basic Life Support

Introduction

The paediatric basic life support guidelines have been changed, partly in response to convincing new scientific evidence, and partly to simplify them in order to assist teaching and retention. As in the past, there remains a paucity of good quality evidence specifically on paediatric resuscitation, and some conclusions have had to be drawn from experimental work or extrapolated from adult data.

These guidelines have a strong focus on simplification, based on the knowledge that many children receive no resuscitation at all because rescuers fear doing harm as they have not been taught specific paediatric resuscitation. Consequently, a major area of discussion during the development of Guidelines 2005 has been the feasibility of applying the same guidelines to children as to adults.

Bystander resuscitation improves outcome significantly. There is good evidence from experimental models that doing either chest compression or expired air ventilation alone may result in a better outcome than doing nothing.¹ It follows that outcomes could be improved if bystanders who would otherwise do nothing, were encouraged to begin resuscitation, even if they do not follow an algorithm targeted specifically at children. There are, however, distinct differences between the predominantly adult arrest of cardiac origin and the asphyxial arrest which occurs commonly in children. Therefore, a separate paediatric algorithm is justified for healthcare professionals with a duty to respond to paediatric emergencies, who are in a position to receive enhanced training.

Guideline changes

Compression:ventilation ratios

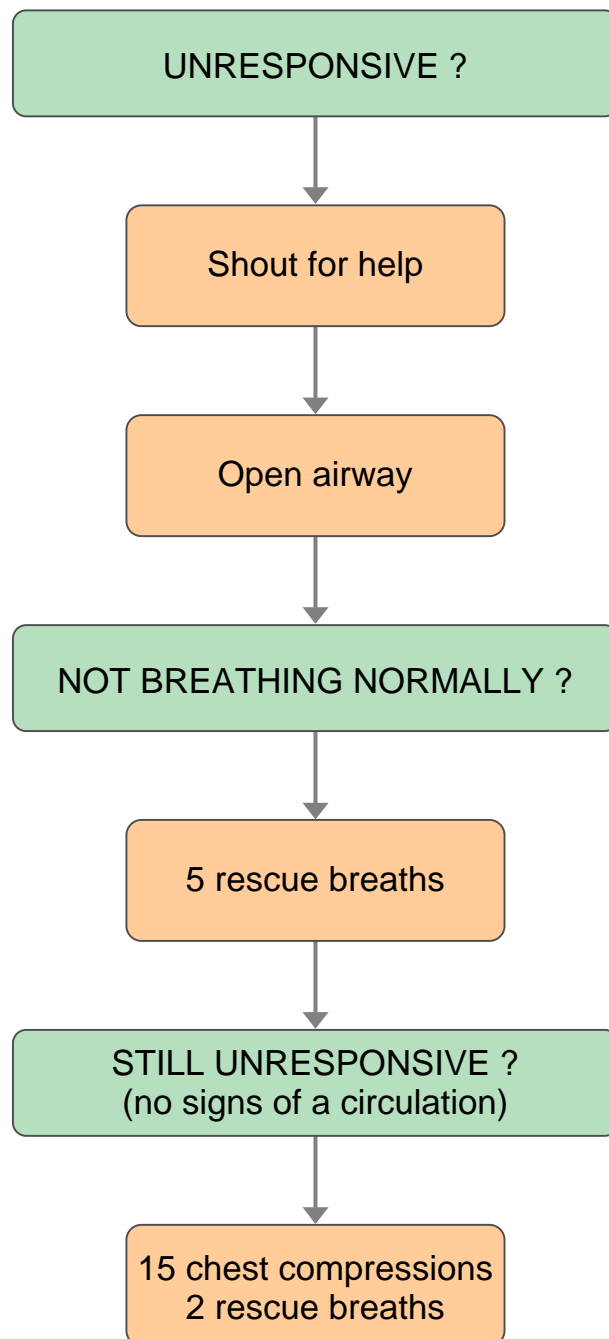
- Lay rescuers should use a ratio of 30 compressions to 2 ventilations.
- Two or more rescuers with a duty to respond should use a ratio of 15 compressions to 2 ventilations.

Age definitions

- An infant is a child under 1 year.
- A child is between 1 year and puberty.

Paediatric Basic Life Support

(Healthcare professionals
with a duty to respond)



After 1 minute call resuscitation team then continue CPR

Automated external defibrillators

- A standard AED can be used in children over 8 years.
- Purpose-made paediatric pads, or programs which attenuate the energy output of an AED, are recommended for children between 1 and 8 years.
- If no such system or manually adjustable machine is available, an unmodified adult AED may be used for children older than 1 year.
- There is insufficient evidence to support a recommendation for or against the use of AEDs in children less than 1 year.

Foreign body airway obstruction sequence

- A simplified sequence of actions should be used for the management of foreign body airway obstruction (FBAO) in infants and children.

Infant and child BLS sequence

Rescuers who have been taught adult BLS, and have no specific knowledge of paediatric resuscitation, should use the adult sequence. The following modifications to the adult sequence will, however, make it more suitable for use in children:

- Give five initial rescue breaths before starting chest compression (adult sequence step 5B).
- If you are on your own, perform CPR for 1 min before going for help.
- Compress the chest by approximately one-third of its depth. Use two fingers for an infant under 1 year; use one or two hands for a child over 1 year as needed to achieve an adequate depth of compression.

(See adult BLS section)

The following is the sequence that should be followed by healthcare professionals with a duty to respond to paediatric emergencies:

- 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?'
 - Do not shake infants, or children with suspected cervical spine injuries.



3 A 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.

3 B If the child does not respond:

- Shout for help.
- Open the child's airway by tilting the head and lifting the chin:
 - With the child initially in the position in which you find him, place your hand on his 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. 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.

If you suspect that there may have been an injury to the neck, try to open the airway using chin lift or jaw thrust alone. If this is unsuccessful, add head tilt a small amount at a time until the airway is open.

4 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 sec** before deciding that breathing is absent.

5 A If the child is breathing normally:

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

5 B If the child is not breathing or is making agonal gasps (infrequent, irregular breaths):

- Carefully remove any obvious airway obstruction.
- 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', described below.

Rescue breaths for a child over 1 year:

- 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 sec watching for chest rise.
- Maintaining 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 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.
- 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 both be covered in the older infant, the rescuer may attempt to seal only the infant's nose or mouth with his mouth (if the nose is used, close the lips to prevent air escape).
- Blow steadily into the infant's mouth and nose over 1-1.5 sec 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 5 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 compression.

6 Check for signs of a circulation (signs of life):

Take no more than 10 sec to:

- Look for signs of a circulation. These include any movement, coughing, or normal breathing (not agonal gasps - these are infrequent, irregular breaths).



- Check the pulse (if you are trained and experienced) **but ensure you take no more than 10 sec 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.

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

- Continue rescue breathing, if necessary, until the child starts breathing effectively on his own.
- Turn the child onto his side (into the recovery position) if he remains unconscious.
- Re-assess the child frequently.

**7 B If there are no signs of a circulation,
or no pulse,
or a slow pulse (less than 60 min⁻¹ with poor perfusion),
or you are not sure:**

- Start chest compression.
- Combine rescue breathing and chest compression.

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. Compress the sternum one finger's breadth above this.
- Compression 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 about 100 min⁻¹.
- 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 min⁻¹, the actual number delivered will be less than 100 because of pauses to give breaths. The best method for compression varies slightly between infants and children.

Chest compression in infants:

- The lone rescuer should compress the sternum with the tips of two fingers.
- If there are two 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 your two thumbs to depress it approximately one-third of the depth of the infant's chest.

Chest compression in children over 1 year:

- 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 victim'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.

8 Continue resuscitation until:

- the child shows signs of life (spontaneous respiration, pulse, movement);
- further 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 starts resuscitation while another goes for assistance.
- If only one rescuer is present, undertake resuscitation for about **1 min** before going for assistance. To minimise interruptions in CPR, it may be possible to carry an infant or small child whilst summoning help.
- The only exception to performing 1 min of CPR before going for help is in the case of a child with a **witnessed, sudden** collapse when the rescuer is alone. In this case cardiac arrest is likely to be an arrhythmia and the child may need defibrillation. Seek help immediately if there is no one to go for you.

Explanatory notes

Definitions

An **infant** is a child under 1 year.

A **child** is between 1 year and puberty. It is neither appropriate nor necessary to establish onset of puberty formally. If the rescuer believes the victim to be a child he should use the paediatric guidelines.

Compression:ventilation ratios

The publication, *2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations* (CoSTR), recommends that the compression:ventilation ratio should be based on whether one or more rescuers are present. CoSTR also recommends that lay rescuers, who usually learn only single-rescuer techniques, should be taught to use a ratio of 30 compressions to 2 ventilations. This is the same ratio as recommended for adults and enables anyone trained in BLS techniques to resuscitate children with minimal additional information. Two or more rescuers with a duty to respond should learn a ratio with more rescue breaths (15:2), as this has been validated by experimental and mathematical studies.^{2,3} This latter group, who would normally be healthcare professionals, should receive enhanced training targeted specifically at the resuscitation of children.

Although there are no data to support the superiority of any particular ratio in children, ratios of between 5:1 and 15:2 have been studied and there is increasing evidence that the 5:1 ratio delivers an inadequate number of compressions.^{4,5} There is certainly no justification for having two separate ratios for children greater or less than 8 years, so a single ratio of 15:2 for multiple rescuers with a duty to respond is a logical simplification.

Although the CoSTR recommendation is based on the number of rescuers present, it would certainly negate the main benefit of simplicity if lay rescuers were taught a different ratio for use if there were two of them. Similarly, those with a duty to respond, who would normally be taught to use a ratio of 15:2, should not be compelled to use the 30:2 ratio if they are alone, unless they are not achieving an adequate number of compressions because of difficulty in the transition between ventilation and compression.

Age definitions

The adoption of a single compression:ventilation ratio for children of all ages, together with the change in advice on the lower age limit for the use of automated external defibrillators (AEDs), renders the Guidelines 2000 division between children above and below 8 years unnecessary. The differences between adult and paediatric resuscitation are largely based on differing aetiology, with primary cardiac arrest being more common in adults whereas children usually suffer from secondary cardiac arrest. The onset of puberty, which is the physiological end of childhood, is the most logical landmark for the upper age limit for use of

paediatric guidelines. This has the advantage of being simple to determine in contrast to an age limit, as age may be unknown at the start of resuscitation.

Clearly, it is inappropriate and unnecessary to establish the onset of puberty formally; if the rescuer believes the victim to be a child then he should use the paediatric guidelines. If a misjudgment is made, and the victim turns out to be a young adult, little harm will accrue as studies of aetiology have shown that the paediatric pattern of arrest continues into early adulthood.

It is necessary to differentiate between infants and older children, as there are some important differences between these two groups.

Chest compression technique

The modification of age definitions enables a simplification of the advice on chest compression. The method for determining the landmarks for infant compression is now the same as that for older children, as there is evidence that the previous recommendation could result in compression over the upper abdomen.⁶ Infant compression techniques remain the same: two-finger compression for single rescuers and two-thumb encircling technique for two or more rescuers. For older children there is no division between the one- or two-hand techniques;⁷ the emphasis is on achieving an adequate depth of compression with minimal interruptions, using one or two hands according to rescuer preference.

Automated external defibrillators

Since Guidelines 2000 there have been case reports of safe and successful use of AEDs in children less than 8 years. Furthermore, recent studies have shown that AEDs are capable of identifying arrhythmias accurately in children and are extremely unlikely to advise a shock inappropriately. Consequently, advice on the use of AEDs has been revised to include all children greater than 1 year.⁸ Nevertheless, if there is any possibility that an AED may need to be used in children, the purchaser should check that the performance of the particular model has been tested against paediatric arrhythmias.

Many manufacturers now supply purpose-made paediatric pads or programs which typically attenuate the output of the machine to 50-75 J.⁹ These devices are recommended for children between 1 and 8 years. If no such system or manually adjustable machine is available, an unmodified adult AED may be used in children older than 1 year. There is currently insufficient evidence to support a recommendation for or against the use of AEDs in children less than 1 year.

Recovery position

An unconscious child whose airway is clear and who is breathing spontaneously should be turned onto his side into the recovery position. There are several recovery positions; each has its advocates. The important principles to be followed are:



- The child should be placed in as near a true lateral position as possible with his mouth dependant to enable 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.
- There should be no 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.

Foreign body airway obstruction (FBAO)

Recognition of FBAO

When a foreign body enters the airway the child reacts immediately by coughing in an attempt to expel it. A spontaneous cough is likely to be more effective and safer than any manoeuvre a rescuer might perform. However, if coughing is absent or ineffective, and the object completely obstructs the airway, the child will rapidly become asphyxiated. Active interventions to relieve FBAO are therefore required only when coughing becomes ineffective, but they then need to be commenced rapidly and confidently.

The majority of choking events in children occur during play or whilst eating, when a carer is usually present. Events are therefore frequently witnessed, and interventions are usually initiated when the child is conscious.

FBAO is characterised by the sudden onset of respiratory distress associated with coughing, gagging, or stridor. Similar signs and symptoms may also be associated with other causes of airway obstruction, such as laryngitis or epiglottitis, which require different management. Suspect FBAO if:

- the onset was very sudden;
- there are no other signs of illness;
- there are clues to alert the rescuer, for example a history of eating or playing with small items immediately prior to the onset of symptoms.



General signs of FBAO	
<ul style="list-style-type: none">• Witnessed episode• Coughing or choking• Sudden onset• Recent history of playing with or eating small objects	
Ineffective coughing	Effective cough
<ul style="list-style-type: none">• Unable to vocalise• Quiet or silent cough• Unable to breathe• Cyanosis• Decreasing level of consciousness	<ul style="list-style-type: none">• Crying or verbal response to questions• Loud cough• Able to take a breath before coughing• Fully responsive

Relief of FBAO

Safety and summoning assistance

Safety is paramount. Rescuers should avoid placing themselves in danger and consider the safest action to manage the choking child:

- If the child is coughing effectively, then no external manoeuvre is necessary. Encourage the child to cough, and monitor continuously.
- If the child's coughing is, or is becoming, ineffective, **shout for help** immediately and determine the child's conscious level.

Conscious child with FBAO

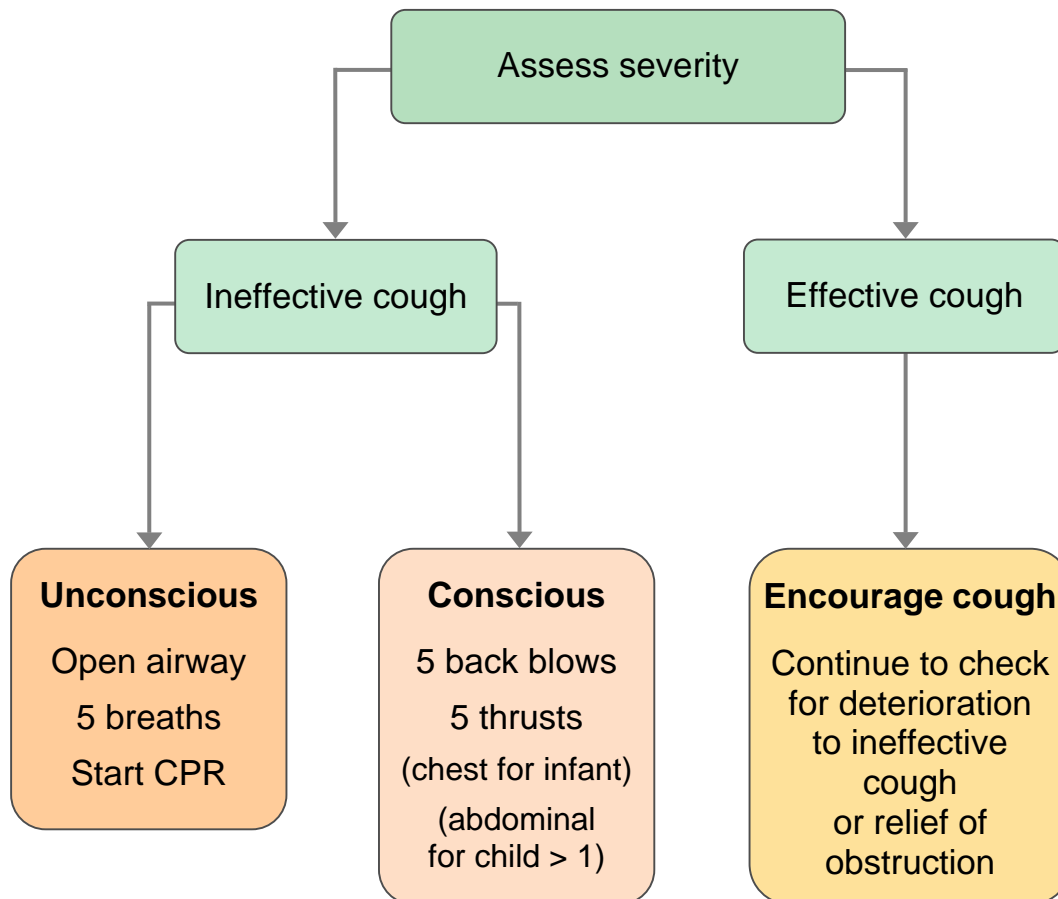
- If the child is still conscious but has absent or ineffective coughing, give back blows.
- If back blows do not relieve the FBAO, give chest thrusts to infants or abdominal thrusts to children. These manoeuvres create an 'artificial cough' to increase intrathoracic pressure and dislodge the foreign body.

Back blows

In an infant:

- Support the infant in a head-downwards, prone position, to enable gravity to assist removal of the foreign body.
- A seated or kneeling rescuer should be able to support the infant safely across his lap.

Paediatric FBAO Treatment





- Support the infant's head by placing the thumb of one hand at the angle of the lower jaw, and one or two fingers from the same hand at the same point on the other side of the jaw.
- Do not compress the soft tissues under the infant's jaw, as this will exacerbate the airway obstruction.
- Deliver up to 5 sharp back blows with the heel of one hand in the middle of the back between the shoulder blades.
- The aim is to relieve the obstruction with each blow rather than to give all 5.

In a child over 1 year:

- Back blows are more effective if the child is positioned head down.
- A small child may be placed across the rescuer's lap as with an infant.
- If this is not possible, support the child in a forward-leaning position and deliver the back blows from behind.

If back blows fail to dislodge the object, and the child is still conscious, use chest thrusts for infants or abdominal thrusts for children. **Do not use abdominal thrusts (Heimlich manoeuvre) for infants.**

Chest thrusts for infants:

- Turn the infant into a head-downwards supine position. This is achieved safely by placing your free arm along the infant's back and encircling the occiput with your hand.
- Support the infant down your arm, which is placed down (or across) your thigh.
- Identify the landmark for chest compression (lower sternum approximately a finger's breadth above the xiphisternum).
- Deliver 5 chest thrusts. These are similar to chest compressions, but sharper in nature and delivered at a slower rate.

Abdominal thrusts for children over 1 year:

- Stand or kneel behind the child. Place your arms under the child's arms and encircle his torso.
- Clench your fist and place it between the umbilicus and xiphisternum.
- Grasp this hand with your other hand and pull sharply inwards and upwards.
- Repeat up to 5 times.
- Ensure that pressure is not applied to the xiphoid process or the lower rib cage as this may cause abdominal trauma.



Following chest or abdominal thrusts, reassess the child:

- If the object has not been expelled and the victim is still conscious, continue the sequence of back blows and chest (for infant) or abdominal (for children) thrusts.
- Call out, or send, for help if it is still not available.
- Do not leave the child at this stage.

If the object is expelled successfully, assess the child's clinical condition. It is possible that part of the object may remain in the respiratory tract and cause complications. If there is any doubt, seek medical assistance. Abdominal thrusts may cause internal injuries and all victims so treated should be examined by a medical practitioner.

Unconscious child with FBAO

- If the child with FBAO is, or becomes, unconscious place him on a firm, flat surface.
- Call out, or send, for help if it is still not available.
- Do not leave the child at this stage.

Airway opening:

- Open the mouth and look for any obvious object.
- If one is seen, make an attempt to remove it with a single finger sweep.

Do not attempt blind or repeated finger sweeps - these can impact the object more deeply into the pharynx and cause injury.

Rescue breaths:

- Open the airway and attempt 5 rescue breaths.
- Assess the effectiveness of each breath: if a breath does not make the chest rise, reposition the head before making the next attempt.

Chest compression and CPR:

- Attempt 5 rescue breaths and if there is no response, proceed immediately to chest compression regardless of whether the breaths are successful.
- Follow the sequence for single rescuer CPR (step 7B above) for approximately 1 min before summoning EMS (if this has not already been done by someone else).
- When the airway is opened for attempted delivery of rescue breaths, look to see if the foreign body can be seen in the mouth.
- If an object is seen, attempt to remove it with a single finger sweep.



- If it appears that the obstruction has been relieved, open and check the airway as above. Deliver rescue breaths if the child is not breathing.
- If the child regains consciousness and is breathing effectively, place him in a safe side-lying (recovery) position and monitor breathing and conscious level whilst awaiting the arrival of EMS.

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