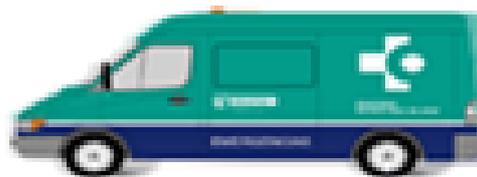
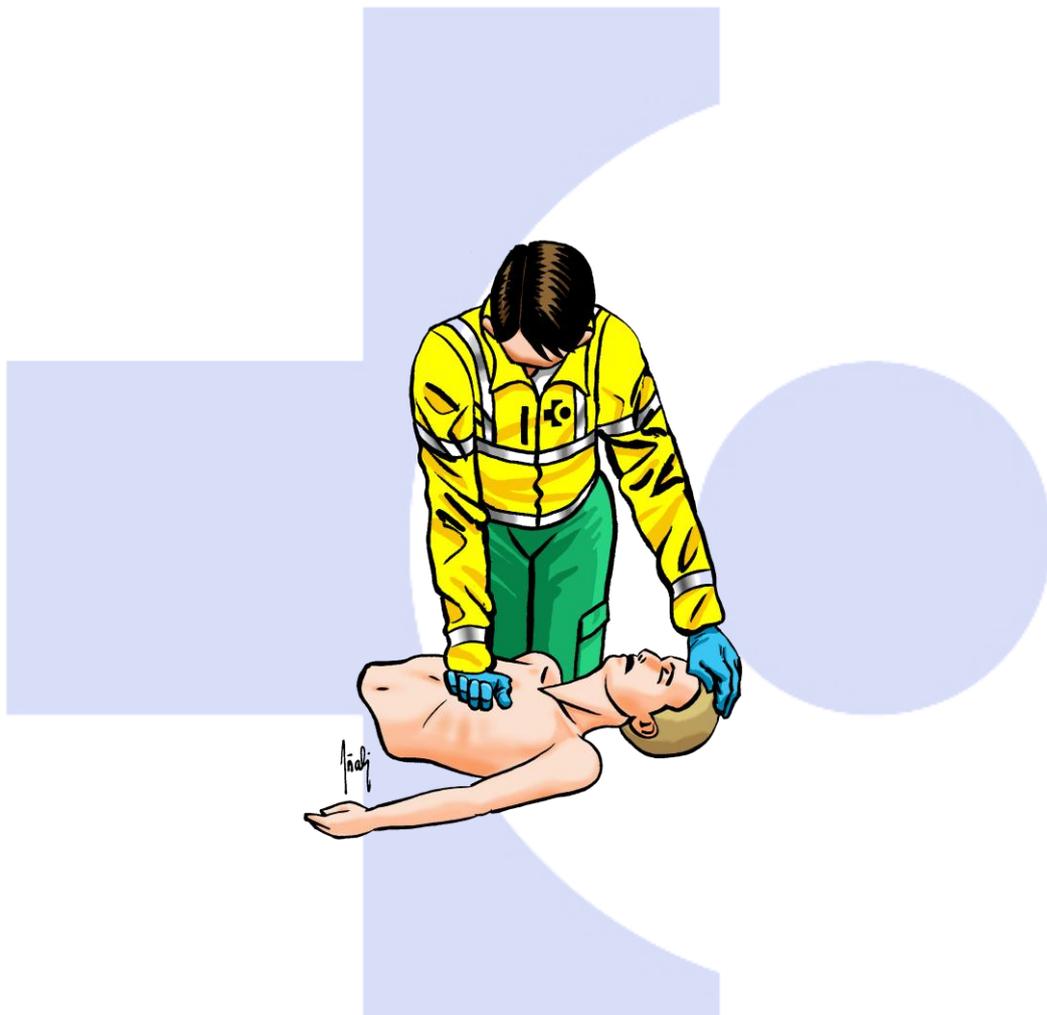


NOTES ON HOW TO ACT IN RESPONSE TO AN OUT-OF-HOSPITAL CARDIAC ARREST



Emergentziak
Emergencias

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GLOSSARY

OHCA.- Out-of-Hospital Cardiac Arrest

CA.- Cardiac Arrest

CPR.- Cardiopulmonary Resuscitation

BLS.- Basic Life Support

AED.- Automated External Defibrillation

RP.- Recovery Position

FBAO.- Foreign Body Airway Obstruction

This text is based on the recommendations of the Guidelines for Resuscitation 2015 of the European Resuscitation Council (ERC).

Illustrations by Iñaki Gutiérrez (Doctor with Emergentziak Osakidetza/Basque Emergency Health Service).

SURVIVAL CHAIN

This is a set of actions that aim to achieve the highest possible survival rate. (Fig. 1.1). It includes a series of links:

- 1) The first link in this chain points out the importance of recognising people at risk of out-of-hospital cardiac arrest (OHCA) and calling for help in the hope that early treatment can prevent the arrest. Once the arrest has occurred, early recognition is critical to enable rapid activation of the emergency services and for bystanders to begin Cardiopulmonary Resuscitation (CPR).
- 2) The central links represent the integration of CPR and defibrillation as the fundamental components of early resuscitation in an attempt to restore life. Immediate CPR may double or quadruple the chances of survival of cardiac arrest (CA) by Ventricular Fibrillation. Bystanders who are trained in CPR should carry out chest compressions and rescue breaths. If the person who calls is not trained, the emergency telephone operators should instruct the bystanders to perform only chest compressions until the arrival of help. Carrying out CPR with chest compressions only is better than not performing CPR. After a CA due to ventricular fibrillation, CPR with defibrillation within 3-5 minutes after the arrest can achieve survival rates as high as 50-70%. Each minute of delay in defibrillation reduces the probability of survival by around 10%. Public access to defibrillation can help achieve the high survival rates.
- 3) In the final link in the survival chain, advanced life support with airway management, drugs and the correction of causal factors of the CA may be essential. Post-resuscitation care, which aims to preserve the function of brain and heart, is also important.

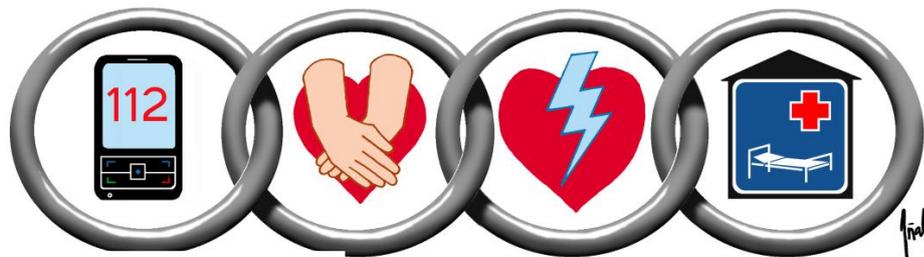


Figure 1.1.- Survival Chain

ADULT BASIC LIFE SUPPORT (BLS)

Adult BLS sequence

Adult basic life support comprises the following sequence of actions (Fig.1.2)

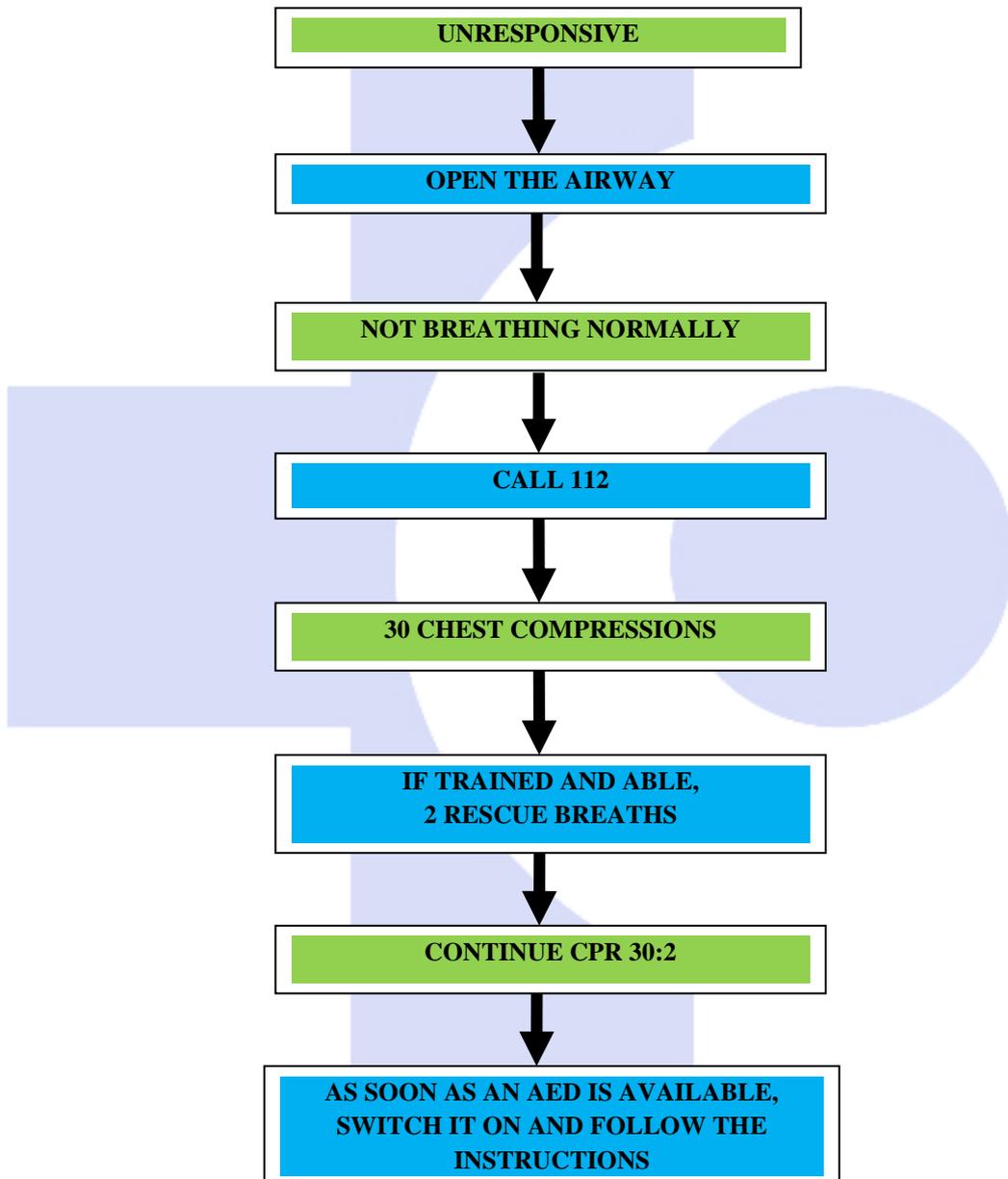


Figure 1.2.- Basic life support and automated external defibrillator (BLS/AED) algorithm

1. Make sure that you, the victim and any bystanders are safe.
2. Check the victim for a response:
 - Gently shake their shoulders and ask loudly: “Are you all right?”

3a. If they respond:

- Leave them in the position in which you found them, provided there is no further danger.
- Try to find out what is wrong with them and get help if needed.
- Reassess them regularly.



3b. If they do not respond:

- Turn the victim onto their back and open the airway using the head tilt-chin lift manoeuvre;
- Place your hand on their forehead and gently tilt their head back;
- With your fingertips under the point of the victim’s chin, lift the chin to open the airway.

4. Keeping the airway open, check if breathing is normal:

- Observe the chest movement;
- Listen in the mouth of the victim for the sounds of breathing;
- Feel for air against your cheek;
- Decide if breathing is normal, abnormal or absent.



In the first few minutes after CA, a victim may be barely breathing, or taking infrequent, slow and noisy gasps.

Do not confuse this with normal breathing. Look, listen and feel for no more than 10 seconds to determine whether the victim is breathing normally. If you have any doubt whether breathing is normal, act as if they are not breathing normally **and** prepare to start CPR.

5a. If they are breathing normally:

- Place them in the recovery position (RP).



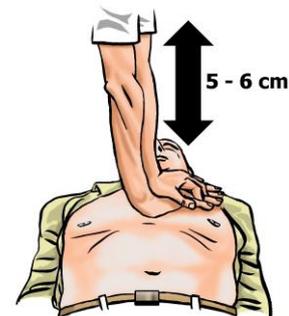
- Send someone or go for help – call 112 or the local emergency number requesting an ambulance;
- Continue checking that breathing continues to be normal.

5b. If the breathing is not normal or is absent:

- Send someone for help and to find and bring an AED if available. If you are on your own, use your mobile phone to call the emergency services. Only leave the victim alone when there is no other choice.
- Activate the “hands free” function on the phone to aid communication with the emergency operator.

▪ Start chest compressions as follows:

- ✓ Kneel by the side of the victim;
- ✓ Place the heel of one hand in the centre of the victim’s chest, which is the lower half of the victim’s breastbone or sternum;
- ✓ Place the heel of your other hand on top of the first hand;
- ✓ Interlock the fingers of your hands and ensure that pressure is not applied over the victim’s ribs. Keep your arms straight. Do not apply any pressure over the upper abdomen or the bottom end of the sternum (breastbone);
- ✓ Position yourself vertically above the victim’s chest and press down on the sternum to a depth of 5-6 cm;
- ✓ After each compression, release all the pressure on the chest without losing contact between your hands and the sternum; repeat at a rate of between 100 and 120 per minute;
- ✓ The compression and decompression should last for the same amount of time.



6a. If you are trained and able to perform rescue breaths, combine the chest compressions with rescue breaths.

- After 30 compressions, open the airway again using head tilt and chin lift.
- Pinch the soft part of the nose closed, using the index finger and thumb of the hand you have on the forehead.
- Allow the mouth to open, but maintain chin lift.
- Take a normal breath and place your lips around their mouth, making sure that you have a good seal.
- Blow steadily into the mouth while watching for the chest to rise, taking about 1 second as in normal breathing; this is an effective rescue breath.



- Maintaining the head tilt and chin lift, take your mouth away from the victim and watch for the chest to fall as air comes out.
- Take another normal breath and blow into the victim's mouth once more to achieve a total of two effective rescue breaths. Do not interrupt compressions by more than 10 seconds to deliver two rescue breaths.
- Then return your hands without delay to the correct position on the sternum and continue with the chest compressions and rescue breaths in a ratio of 30:2.
- Stop to reassess the victim only if they begin to regain consciousness: if they move, open their eyes or breathe normally. Otherwise, do not interrupt resuscitation.

If your initial rescue breath does not make the chest rise as in normal breathing, then before your next attempt:

- Look inside the victim's mouth and remove any obstruction;
- Recheck that there is adequate head tilt and chin lift;
- Do not attempt more than two breaths each time before returning to chest compressions.

If more than one rescuer is present, it is advisable to alternate the performing of chest compressions and rescue breaths every 2 minutes to avoid fatigue. Ensure that interruption of chest compressions is minimal during the changeover of rescuers.

6b. CPR with chest compressions can only be used as follows:

- If you are not trained to, or are unwilling to give rescue breaths, give chest compressions only;
- If only chest compressions are given, these should be continuous at a rate of 100 to 120 per minute.

7. Do not interrupt resuscitation until:

- A healthcare professional arrives to replace you; or
- The victim begins to regain consciousness: moving, opening their eyes or breathing normally; or
- You become exhausted.

FOREIGN BODY AIRWAY OBSTRUCTION (CHOKING)

Foreign body airway obstruction (FBAO) is an uncommon but potentially treatable cause of accidental death. In many cases, given that these are usually witnessed, the victim is conscious and responsive and so there is more chance of an early intervention which can be lifesaving.

The signs and symptoms enabling differentiation between mild and severe airway obstruction are summarised in the following table:

Differentiating between moderate and severe foreign body airway obstruction (FBAO)

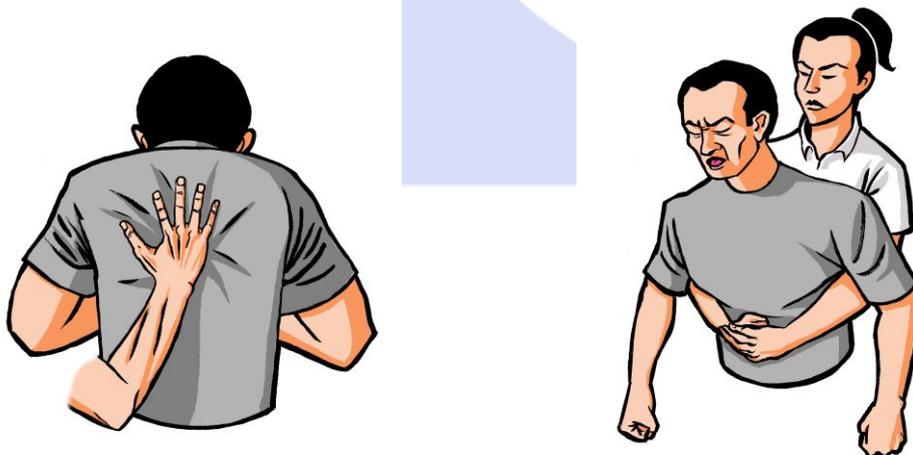
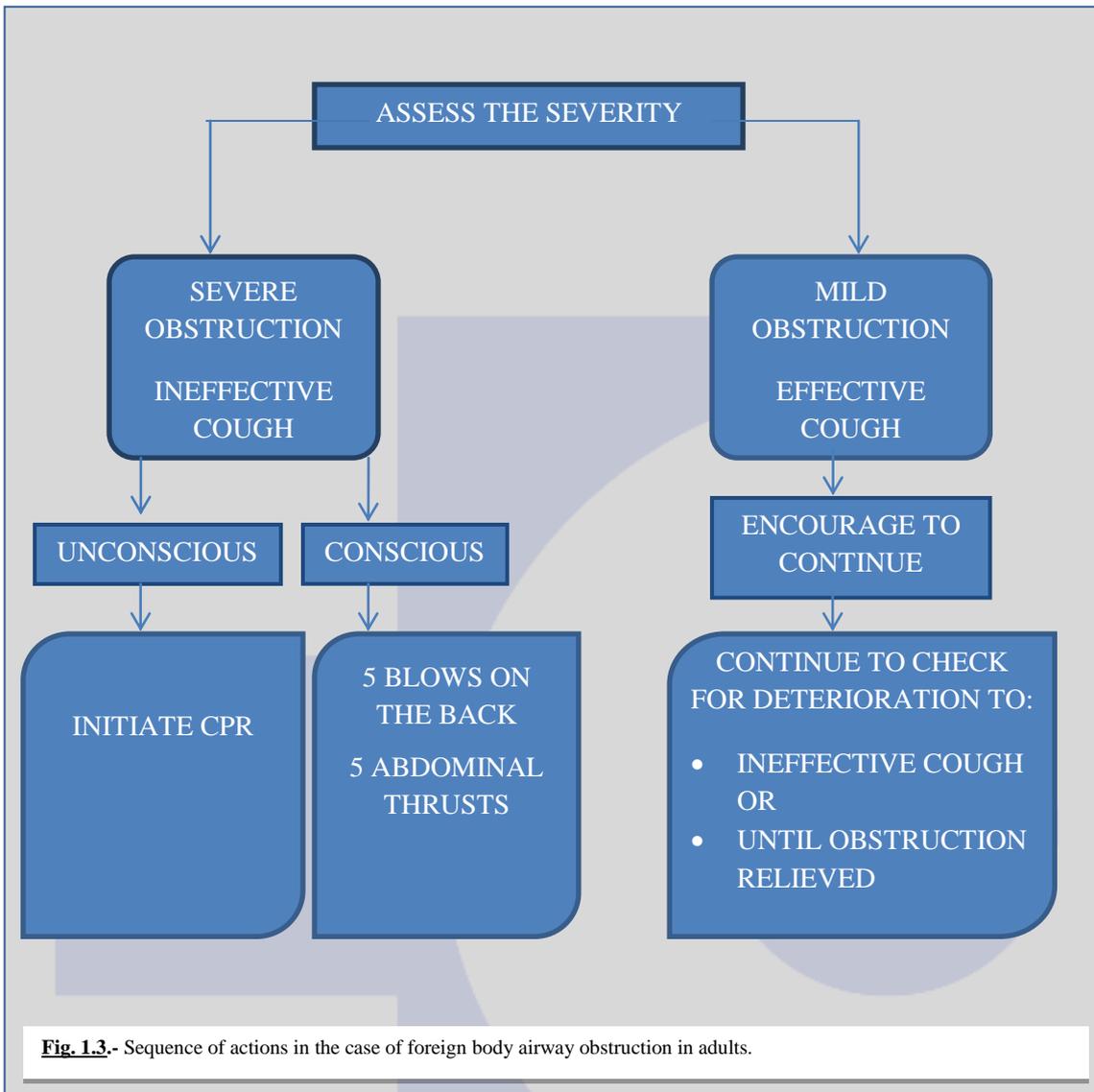
Moderate/Severe Sign	Moderate obstruction	Severe obstruction
Are you choking?	“Yes”	Inability to speak, may respond by nodding
Other signs	Is able to speak, cough, breathe	Cannot breathe / Wheezing / Cannot cough / Unconscious

General symptoms of FBAO: appear while the victim is eating, and the victim may clutch their throat.



The sequence for FBAO (choking) in adults is shown in Figure 1.3.

TREATMENT OF FOREIGN BODY AIRWAY OBSTRUCTION IN AN ADULT



AUTOMATED EXTERNAL DEFIBRILLATORS AND DEFIBRILLATION

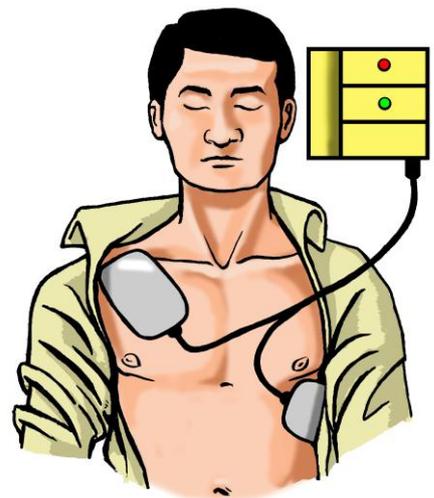
Automated external defibrillators

Automated external defibrillators (AEDs) are safe and effective when used by laypeople with minimal or no training as well as by healthcare professionals (inside or outside hospital). The use of an AED by a layperson makes it possible to defibrillate many minutes before professional help arrives.

Sequence of AED use

The ERC's algorithm for the AED is shown in Fig. 1.4.

1. Make sure that you, the victim and any bystanders are safe.
2. Follow the adult BLS sequence:
 - If the victim does not respond and is not breathing normally, send someone for help and to find and bring an AED if available.
 - If you are on your own, use your mobile phone to call the emergency services – only leave the victim alone when there is no other choice.
3. Initiate the CPR following the adult BLS sequence. If you are alone and an AED is available, begin application of the AED.
4. As soon as the AED arrives:
 - Switch on the AED and attach the electrode pads on the victim's bare chest.
 - If more than one rescuer is present, CPR should be continued while the electrode pads are being attached.
 - Follow the visual/spoken instructions immediately.
 - Ensure that nobody is touching the victim while the AED is analysing the rhythm.



5a. If a shock is indicated:

- Ensure that nobody is touching the victim.
- Push the shock button as indicated.
- Immediately resume CPR 30:2
- Continue as directed by the visual/voice prompts.

5b. If no shock is indicated:

- Immediately resume CPR, using a ratio of 30 chest compressions to 2 rescue breaths.
- Continue as directed by the visual/voice prompts.

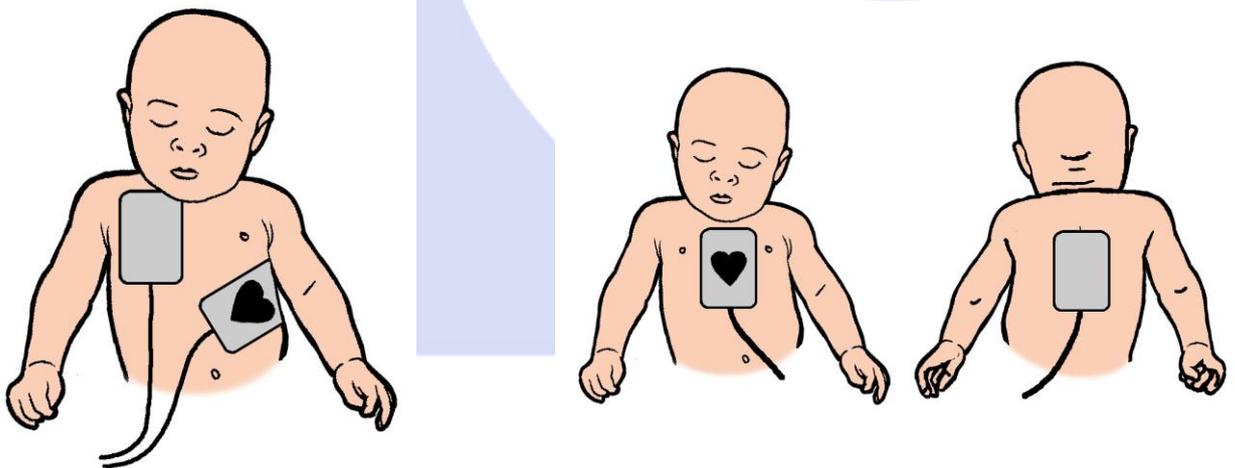
6. Continue following the instructions of the AED until:

- A healthcare professional arrives and takes over.
- The victim begins to regain consciousness: moving, opening their eyes or breathing normally.
- You become exhausted.

Paediatric defibrillation

The AEDs are safe and effective when used in children, but some considerations should be taken into account:

- Standard AEDs are suitable for use in children over 8 years.
- Paediatric patches are recommended in children between 1-8 years, or the device itself should have a dose attenuator system, in order to be adapted to them. In case these two possibilities are not available, an unmodified adult AED can be used in children over one year.
- As for children under one year, in the rare case a shockable rhythm occur, the use of an AED is reasonable, preferably with dose attenuator.
- It is not defined what the best position of the adhesive electrodes in children is, so both the antero-lateral and antero-posterior placement can be used interchangeably.



AUTOMATED EXTERNAL DEFIBRILLATION

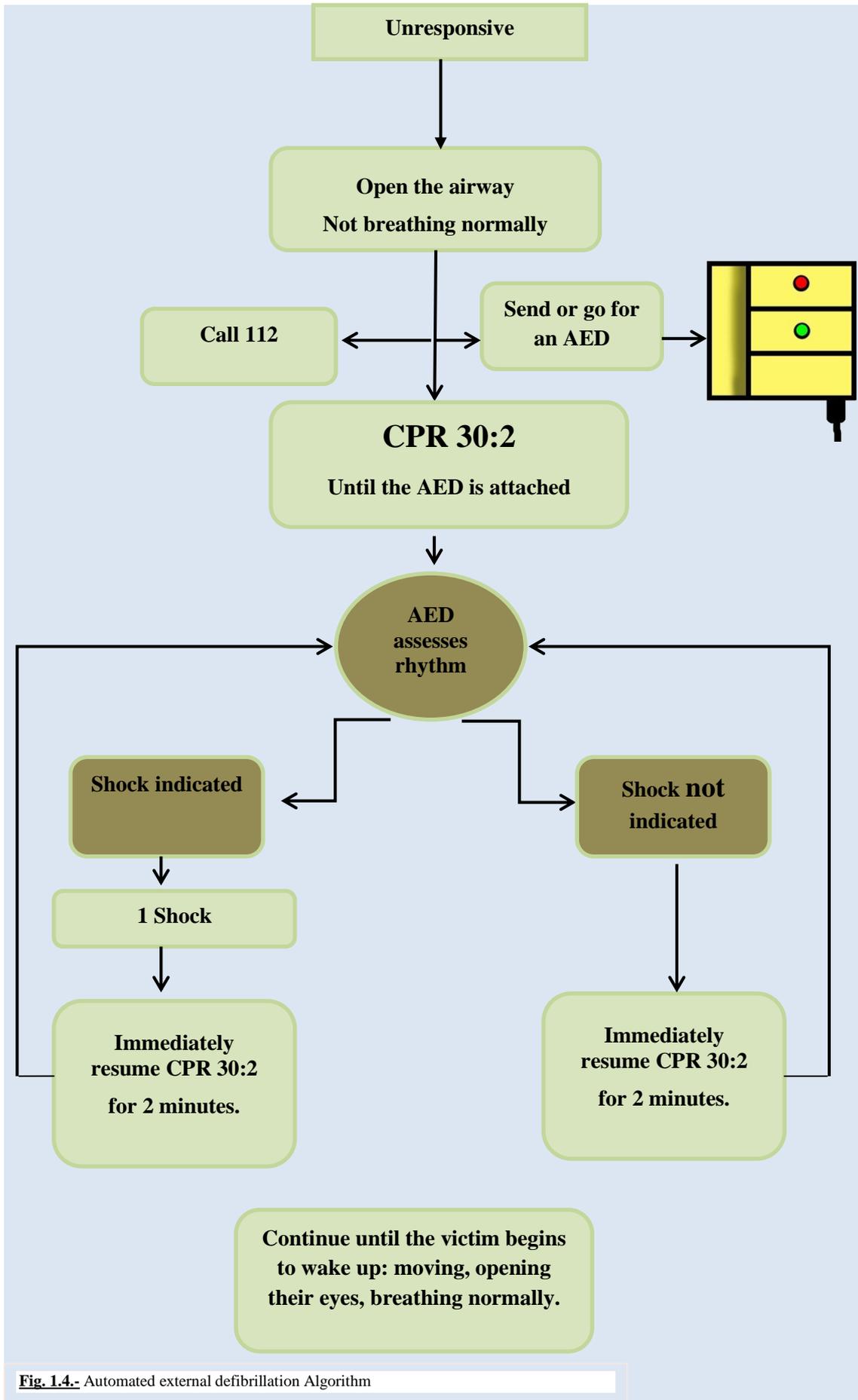


Fig. 1.4.- Automated external defibrillation Algorithm

PAEDIATRIC BASIC LIFE SUPPORT

Sequence of actions

Rescuers who have learned basic CPR for adults and do not have specific knowledge of paediatric CPR can use the adult sequence, since the prognosis for the victim would be worse if they did nothing. Non-healthcare professionals who wish to learn paediatric CPR because they are responsible for the care of children (e.g. teachers, school nurses, lifeguards) should be taught that it is better to change the sequence of basic “adult” CPR and perform five initial rescue breaths followed by a minute long CPR before seeking help.



The paediatric basic life support sequence described in Fig. 1.5:

PAEDIATRIC BASIC LIFE SUPPORT

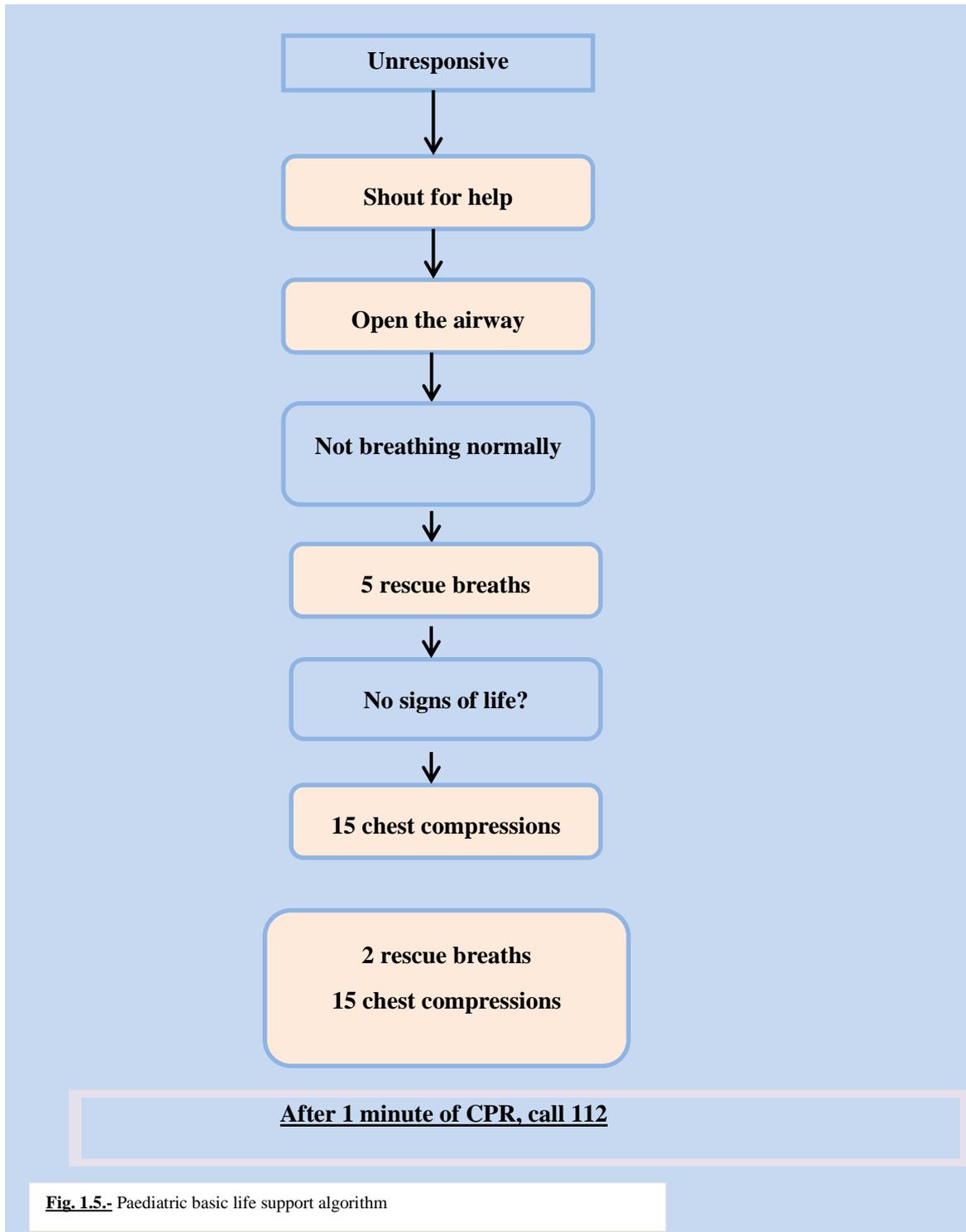


Fig. 1.5.- Paediatric basic life support algorithm

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?'
- 3a. If the child responds by answering, moving or crying:
 - Leave the child in the position in which you found him (provided they are not in further danger).
 - Check their condition and get help if needed.
 - Reassess their condition regularly.
- 3b. If the child does not respond:
 - Shout for help.
 - Turn the child onto their back.
 - Open the child's airway using head tilt and chin lift. To do this:
 - ✓ Place your hand on their forehead and gently tilt their head back.
 - ✓ At the same time, with your fingertips 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 jaw bone and push the jaw forward.
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 exhaled air on your cheek.

In the first few minutes after cardiac arrest, a child may be taking infrequent, "noisy gasps". Look, listen, and feel for no more than 10 seconds before making a decision. If you have any doubts whether breathing is normal or not, act as if it is not normal.

5a. If the child is breathing normally:

- Turn the child onto their side into the recovery position.
- Send or go for help. Call the relevant local emergency number and request an ambulance.
- Check regularly for continued normal breathing.

5b. If the breathing is not normal or is absent:

- Carefully remove any airway obstruction, if this is visible and accessible. Otherwise, respond as described later in the section on foreign body airway obstruction.
- Give 5 initial rescue breaths.
- While performing the rescue breaths, note any response to your action in the form of movement, breathing or coughing. These responses, or their absence, will form part of your assessment of “signs of life”.

Rescue breaths for a child over one year old:

- Keep the airway open with the head tilt and chin lift.
- Pinch the soft part of the child’s nose closed with the index finger and thumb and placing your hand on their forehead.
- Allow the mouth to open, but maintain the chin lift.
- Take a breath and place your lips around the child’s mouth, making sure that you have a good seal.
- Blow steadily into the child’s mouth for 1 second and check that the chest rises.
- Maintaining head tilt and chin lift, take your mouth away from the victim and watch for the child’s chest to fall as air comes out.
- Take another breath and repeat this sequence, five times in total. Check effectiveness by seeing that the child’s chest has risen and fallen each time, 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 lift the chin.
- Take a breath and cover the mouth and nose of the infant with your mouth, making sure you have a good seal. If the size of the infant means that the nose and mouth cannot both be covered, the rescuer may attempt to seal only the infant's nose or mouth (if the nose is used, close the lips to prevent air escape).
- Blow steadily into their mouth for 1 second, sufficient to make the chest rise visibly.
- Maintain head position and chin lift, take your mouth away, and watch for the victim's chest to fall as air comes out.
- Take another breath and repeat this sequence, five times in total.

For both infants and children, if you have difficulty achieving an effective breath, the airway may be obstructed. In this case:

- 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 and 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 to achieve effective breaths, and if still unsuccessful, begin with chest compression.

6. Assess the child's circulation:

For no more than 10 seconds, look for signs of life. These include any movement, coughing, or normal breathing (not abnormal gasps or irregular breaths).

7a. If in these 10 seconds you are confident you have detected signs of life:

- Continue rescue breathing, if necessary, until the child starts breathing effectively on their own.
- If they remain unconscious, turn the child onto their side (into the recovery position).
- Reassess the child frequently.

7b. If there are no signs of life:

- Start chest compressions.
- Combine rescue breaths and chest compressions.

Chest compressions

For all children, compress the lower half 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. The force of compression should be sufficient to depress the sternum by at least one-third of the depth of the chest. Do not be afraid of pushing too hard: "push hard and fast". Release the pressure completely and then repeat at a rate of between 100 and 120 per 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. The best method for compression varies slightly between infants and children.

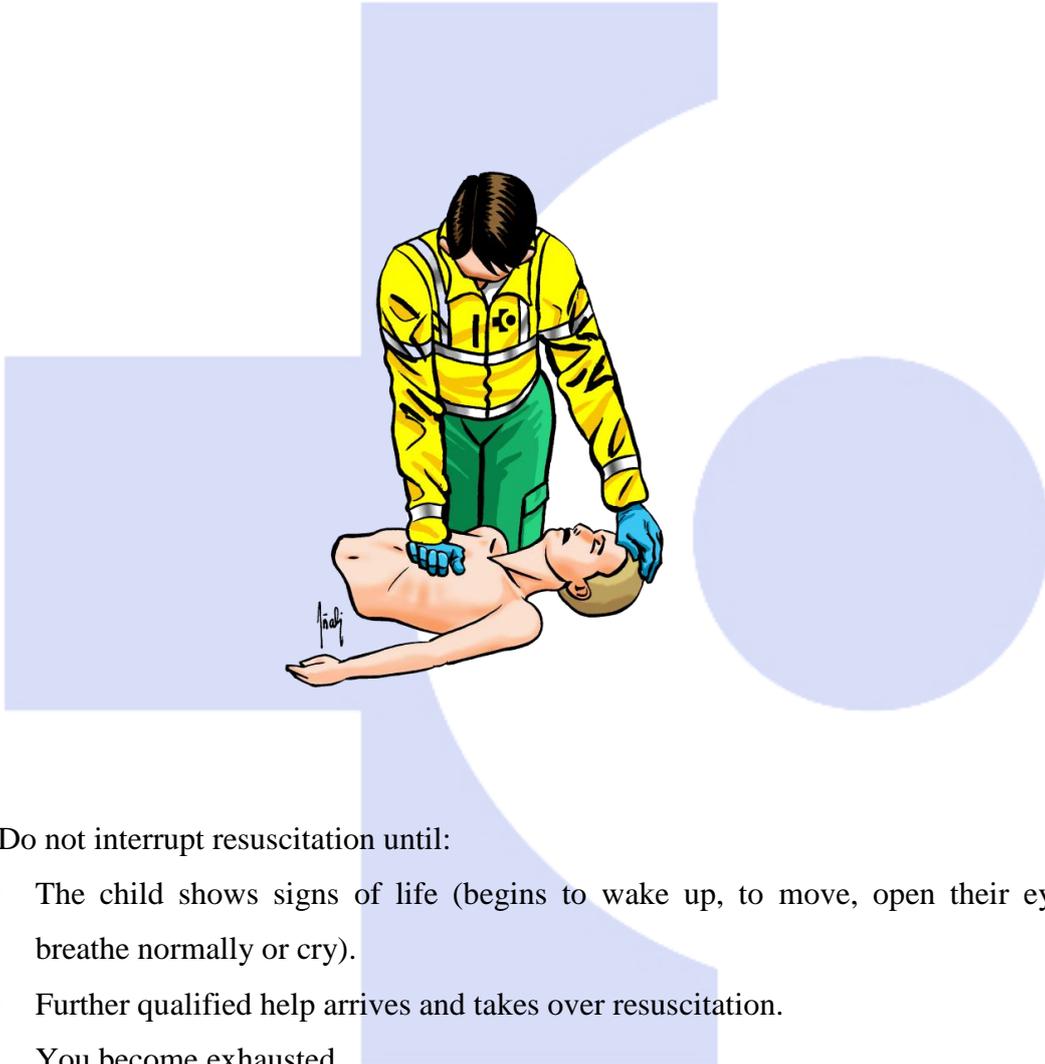
Chest compression in infants (less than one year old)

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 half 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. With both methods, press down on the lower sternum to depress it at least one-third of the depth of the infant's chest (approximately 4 cm).



Chest compression in children over one year old

Place the heel of one hand over the lower half of the sternum (as explained above), lifting 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 at least one-third of the diameter of the chest (approximately 5 cm). In larger children, or for small rescuers, this may be achieved most easily by using both hands with the fingers interlocked.



8. Do not interrupt resuscitation until:
 - The child shows signs of life (begins to wake up, to move, open their eyes, breathe normally or cry).
 - Further qualified help arrives and takes over resuscitation.
 - You become exhausted.

When to call for assistance

It is vital for rescuers to get help as quickly as possible when a child collapses (a sudden loss of consciousness with absence of “signs of life”).

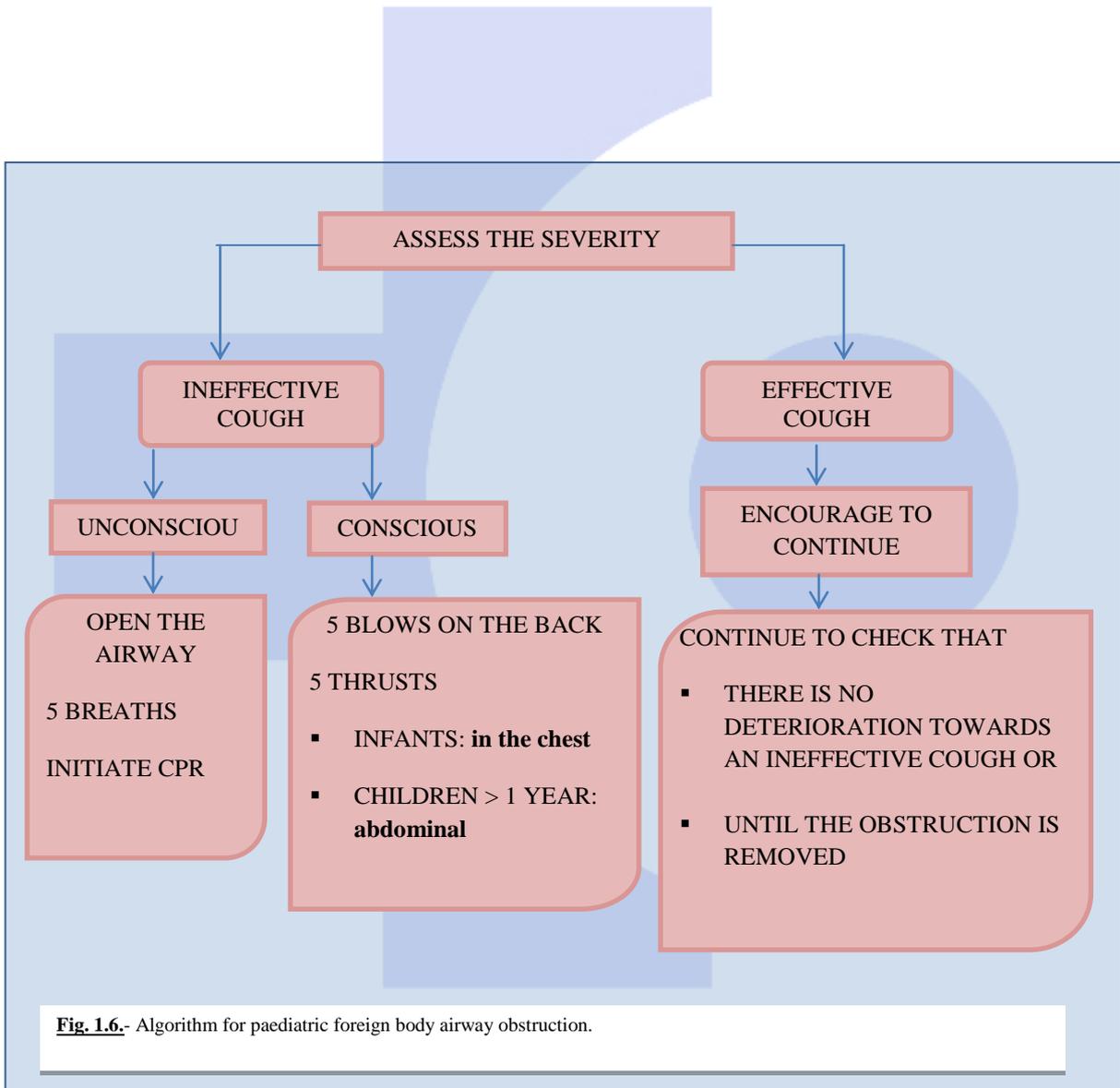
- When more than one rescuer is available, one starts CPR while another goes for assistance.
- If only one rescuer is present, they should undertake CPR for one minute before going for assistance. To minimise interruptions in CPR, it may be possible for a rescuer to carry an infant or small child in their arms, continuing CPR whilst summoning help.
- The only exception to performing one minute of CPR before going for help is in the event of a child with a witnessed, sudden collapse when the rescuer is alone. In this situation, it is likely that the cardiac arrest has been caused by an arrhythmia and the child may need defibrillation. Seek help immediately if there is no one to go for you.

Recovery position

An unconscious child whose airway is clear and who is breathing normally should be turned onto their side into the recovery position. The recovery position for adults is also suitable for children.

FOREIGN BODY AIRWAY OBSTRUCTION IN CHILDREN

Back blows, chest thrusts and abdominal thrusts all increase intra-thoracic pressure and can help expel foreign bodies from the airway. In half of the episodes, more than one technique is needed to relieve the obstruction. There are no data to indicate which technique should be used first or in which order they should be applied. If one is unsuccessful, try the others in rotation until the object is cleared.



The main difference from the adult algorithm is that abdominal thrusts should not be used in infants. Although abdominal thrusts have caused injuries in all age groups, the risk is particularly high in infants and young children. This is due to the horizontal position of the ribs, which leave the viscera of the upper abdomen much more exposed to trauma. For this reason, recommendations for the treatment of FBAO are different for children and adults. The signs for recognising a possible FBAO in a child are shown in the following table.

SIGNS OF FOREIGN BODY AIRWAY OBSTRUCTION	
<u>General signs of FBAO</u>	
Witnessed episode Coughing/choking Sudden onset Recent history of playing with/eating small objects	
<u>Ineffective coughing</u> Unable to vocalise Quiet or silent cough Unable to breathe Cyanosis Decreasing level of consciousness	<u>Effective cough</u> Crying or verbal response to questions Loud cough Able to take a breath before coughing Fully responsive

