module 5

transambulance

# Basic life support (BLS) Techniques

## 5.1. Cardio pulmonary resuscitation

### 1.1.The Chain of Survival

The actions linking the victim of sudden cardiac arrest with survival are called the Chain of Survival (Fig. 1). The first link of this chain indicates the importance of recognising those at risk of cardiac arrest and calling for help in the hope that early treatment can prevent arrest. The central links depict the integration of CPR and defibrillation as the fundamental components of early resuscitation in an attempt to restore life.

Immediate CPR can double or triple survival from VF. Performing chest-compression only CPR is better than giving no CPR at all. Following VF, cardiopulmonary resuscitation plus defibrillation within 3–5 min of collapse can produce survival rates as high as 49–75%. Each minute of delay before defibrillation reduces the probability of survival to discharge by 10–12%.

Fig. 1. Chain of survival

The final link in the Chain of Survival, effective post-resuscitation care, is targeted at preserving function, particularly of the brain and heart. In hospital, the importance of early recognition of the critically ill patient and activation of a medical emergency or rapid response team, with treatment aimed at preventing cardiac arrest, is now well accepted. Over the last few years, the importance of the post-cardiac arrest phase of treatment, depicted in the fourth ring of the Chain of Survival, has been increasingly recognised. Differences in post-cardiac arrest treatment may account for some of the inter-hospital variability in outcome after cardiac arrest.

## 1.2. Basic Cardio Pulmonary Resuscitation (CPR)

The end of cardiac activity as determined in the medical and legal field is the death of a person. It is important to keep this premise so that, from now on, it can be understood in all its intensity the concept of Cardio Pulmonary Resuscitation (CPR) and its importance.

By definition, cardiopulmonary arrest (CPA) is consequent on the sudden and unexpected spontaneous circulation and breathing with the peculiarity of being potentially reversible cessation clinical status. This "clinical death" causes an interruption of oxygen supply to vital organs and, if not reversed, in minutes unleashes biological death.

There may be multiple reasons for cardiac arrest, among them are:

- **Acute myocardial infarction.** There was total or almost total deprivation of blood supply (infarction) in the heart muscle. As a result, the affected tissue dies (necrosis) and that area of the heart loses functionality. The amount of heart muscle affected will determine whether the heart Maintains normal electrical activity of cardiac failure or enters science.

- **Sudden death.** In 90% of cases of sudden death, this occurs after a sudden heart attack and usually has no prior symptoms. Congenital arrhythmias are usually behind most cases of sudden death.

- **Severe trauma.** Severe head trauma, severe chest and abdominal trauma or severe bleeding can trigger a PCR. Abdominal trauma can result in heart failure, this is directly associated with internal bleeding from injuries in important organs mainly the **spleen and liver** or breakage of large vessels such as the abdominal aorta. In fact, large uncontrolled external bleeding or internal will lead to cardiac arrest due to lack of blood volume in the circulatory system. Then this is called **hypovolemia** as the cause of the heart stopping.

- **Another cause of PCR of traumatic** importance for the emergency technician is **tension pneumothorax,** in this case, due to a intense closed or open trauma on the pleural cavity, air pressure builds up an obstruction in the pleural cavity thus generating structures to the neighbouring, lung and heart, and with it a failure to pump. Equivalent with cumulative blood is called hemothorax mass.

- **Traffic accidents and domestic accidents** are the main reasons of death in children over one year in developed countries. In cases of less than one year of age it's **sudden infant death.**

- **Final stage of serious illness.** When a serious disease progresses, it gradually deteriorates the health of the patient, it reaches a point where it enters a terminal phase. Regardless of the origin, final organ failure, is the irreversible cessation (asystole) heartbeat which determines the end of the process.

When the stop occurs, the immediate effect is the cessation of blood circulation; this involves the cessation of oxygen ($O_2$) to all tissues. In consequence: the cells begin to die. That said, it is understandable that as time passes the disappearance of cells involve tissue destruction. In no time the functionality of the body will be compromised. It is estimated that every minute that elapses without effective heartbeat, is representing a 10% less chance of survival. Another important fact to be considered is that neurological squeal has difficulty to estimate another pattern: With every minute that the heart remains stationary, the lack of $O_2$ destroys neurons in the brain and the damage caused is irreversible.

The fast the technician identifies the emergency and takes appropriate action makes a significant difference in the patient outcome and therapeutic measures. After analysing the scene and take the necessary safety measures, in a few seconds, never more than thirty, the technician must identify the lifetime risk of the victim and act accordingly.

As on stage acting, after establishing contact with the victim, the task must be to assess the level of consciousness. Given a confirmed unconsciousness, you must **pay attention to the signs of life.** There are further refined recommendations to recognise and immediately activate the emergency response system according to the signs of lack of response and begin cardiopulmonary resuscitation (CPR) if the victim is unresponsive and not breathing or breathing is not normal?

The assessment of respiration in unconscious patients must not only be limited to the presence or absence of the same; it is important to analyse the quality of the frequency, depth, etc.. And, especially, an abnormal breathing, snoring, scarce, difficult, noisy or rude breathing without defined frequency, which does not allow proper lifting of the patient's chest, which is defined as agonal breathing or gasping, breathing equates to current patient universal algorithms to stop the immediate start of resuscitative measures being necessary.

## 1.3 Adult basic life support sequence, according to European Resuscitation Guidelines (2010) Last updated.

Throughout this section, the male gender implies both males and females.
Basic life support comprises the following sequence of actions (Fig. 2) Press here to see graph

1. Make sure you, the victim and any bystanders are safe.

2. Check the victim for a response:
   - gently shake his shoulders and ask loudly: "Are you all right?"

3a. If he responds:
   - leave him in the position in which you find him, provided there is no further danger;
   - try to find out what is wrong with him and get help if needed;
   - reassess him regularly.

3b. If he does not respond:
   - shout for help
   - turn the victim onto his back and then open the airway using head; tilt and chin lift;
   - place your hand on his forehead and gently tilt his 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, look, listen and feel for breathing:
   - look for chest movement;
   - listen at the victim's mouth for breath sounds;
   - feel for air on your cheek;
   - decide if breathing is normal, not normal or absent.

In the first few minutes after cardiac arrest, 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 s. to determine whether the victim is breathing normally. If you have any doubt whether breathing is normal, act as if it is not normal.

5a. If he is breathing normally:

- turn him into the recovery position (see below);
- send or go for help – call 112 or local emergency number for an ambulance;
- continue to assess that breathing remains normal.

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

- send someone for help and to find and bring an AED if available;or if you are on your own, use your mobile phone to alert the ambulance service – leave the victim only when there is no other option;
- start chest compression 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 (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.
  - position yourself vertically above the victim's chest and press down on the sternum at least 5 cm (but not exceeding 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 at least 100 min–1 (but not exceeding 120 min–1);
  - compression and release should take equal amounts of time.

6a. Combine chest compression 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 your hand on the forehead.
- Allow the mouth to open, but maintain chin lift.
- Take a normal breath and place your lips around his mouth, making sure that you have a good seal.
- Blow steadily into the mouth while watching for the chest to rise, taking about 1 s as in normal breathing; this is an effective rescue breath.
- Maintaining 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. The two breaths should not take more than 5 s in all. Then return your hands without delay to the correct position on the sternum and give a further 30 chest compressions.

**• Continue with chest compressions and rescue breaths in a ratio of 30:2.**

• Stop to recheck the victim only if he starts to wake up: to move, opens eyes and to 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 into 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 there is more than one rescuer present, another rescuer should take over delivering CPR every 2min to prevent fatigue. Ensure that interruption of chest compressions is minimal during the changeover of rescuers.

6b. Chest-compression-only CPR may be used as follows:

- if you are not trained, 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 at least 100 min–1 (but not exceeding 120 min–1).

7. Do not interrupt resuscitation until:

- professional help arrives and takes over; or
- the victim starts to wake up: to move, opens eyes and to breathe normally; or
- you become exhausted.

### 1.3.1The use of the music to perform CPR

Several recent studies have examined the use of music to aid CPR performance, in particular rate and quality of compressions. The first was Stayin´Alive by the Bee Gees. According to Matlock et al. (2008), health professionals listening this song, gave chest compressions at mean rate of 109 bpm whilst listening to music and at 113 bpm five weeks later when asked to give CPR "remembering" the tune. Participants reported that utilizing the tune helped them deliver CPR in accordance with guidelines. In other countries as Spain, is most known the song Macarena by Los del Río, usually used to train the technicians and even the hymn of the football team Athletic de Bilbao.

## 1.4. Recognition of cardiorespiratory arrest

Checking the carotid pulse (or any other pulse) is an inaccurate method of confirming the presence or absence of circulation, both for lay rescuers and for professionals. Healthcare professionals, as well as lay rescuers,

have difficulty determining the presence or absence of adequate or normal breathing in unresponsive victims. This may be because the victim is making occasional (agonal) gasps, which occur in the first minutes after onset in up to 40% of cardiac arrests. Laypeople should be taught to begin CPR if the victim is unconscious (unresponsive) and not breathing normally. It should be emphasised during training that the presence of agonal gasps is an indication for starting CPR immediately.

In adults needing CPR, the cardiac arrest is likely to have a primary cardiac cause. So **CPR should start with chest compression rather than initial ventilations**. Time should not be spent checking the mouth for foreign bodies unless attempted rescue breathing fails to make the chest rise.

## 1.5. Ventilation

During CPR, the optimal tidal volume, respiratory rate and inspired oxygen concentration to achieve adequate oxygenation and CO2 removal is unknown. During CPR, blood flow to the lungs is substantially reduced, so an adequate ventilation- perfusion ratio can be maintained with lower

tidal volumes and respiratory rates than normal. Hyperventilation is harmful because it increases intrathoracic pressure, which decreases venous return to the heart and reduces cardiac output. Interruptions in chest compression reduce survival.

Rescuers should give each rescue breath over about 1 s, with enough volume to make the victim's chest rise, but to avoid rapid or forceful breaths. The time taken to give two breaths should not exceed 5 s. These recommendations apply to all forms of ventilation during CPR, including mouth-to-mouth and bag-mask ventilation with and without supplementary oxygen.

## 1.6. Chest compression

Chest compressions generate a small but critical amount of bloodflow to the brain and myocardium and increase the likelihood that defibrillation will be successful. Optimal chest compression technique comprises: compressing the chest at a rate of at least 100 min–1 and **to a depth of at least 5 cm (for an adult), but not exceeding 6 cm**; allowing the chest to recoil completely after each compression; taking approximately the same amount of time for compression as relaxation. Rescuers can be assisted to achieve the recommended compression rate and depth by prompt/feedback devices that are either built into the AED or manual defibrillator, or are stand-alone devices.

### 1.6.1. Compression-only CPR

Some healthcare professionals as well as lay rescuers indicate that they would be reluctant to perform mouth-to-mouth ventilation, especially in unknown victims of cardiac arrest. Animal studies have shown that chest-compression-only CPR may be as effective as combined ventilation and compression in the first few minutes after non-asphyxial arrest. If the airway is open, occasional gasps and passive chest recoil may provide some air exchange, but this may result in ventilation of the dead space only. Animal and mathematical model

studies of chestcompression-only CPR (according to European Society of Cardiology) have shown that arterial oxygen stores deplete in 2–4 min.

adults, the outcome of chest compression without ventilation is significantly better than the outcome of giving no CPR at all in non-asphyxial arrest. Several studies of human cardiac arrest suggest equivalence of chest-compression only CPR and chest compressions combined with rescue breaths, but none of these studies exclude the possibility that chest compression-only inferior to chest compressions combined with ventilations. Chest compression-only may be sufficient only in the first few minutes after collapse. Chest-compression-only CPR is not as effective as conventional CPR for cardiac arrests of non-cardiac origin (e.g., drowning or suffocation) in adults and children.

Chest compression combined with rescue breaths is, therefore, the method of choice for CPR delivered by both trained lay rescuers and professionals. Laypeople should be encouraged to perform compression-only CPR if they

are unable or unwilling to provide rescue breaths, or when instructed during an emergency call to an ambulance dispatcher centre.

## 1.7. Risks to the rescuer

### Physical effects

The incidence of adverse effects (muscle strain, back symptoms, shortness of breath, hyperventilation) on the rescuer from CPR training and actual performance is very low. Several manikin studies have found that, as a result of rescuer fatigue, chest compression depth can decrease as little as 2 min after starting chest compressions. Rescuers should change about every 2 min to prevent a decrease in compression quality due to rescuer fatigue. Changing rescuers should not interrupt chest compressions.

### Risks during defibrillation

A large randomised trial of public access defibrillation showed that AEDs can be used safely by laypeople and first responders. A systematic review identified only eight papers that reported a total of 29 adverse events associated with defibrillation. Only one of these adverse events was published after 1997.

### Disease transmission

There are only very few cases reported where performing CPR has been linked to disease transmission. Three studies showed that barrier devices decreased transmission of bacteria in controlled laboratory settings. Because the risk of disease transmission is very low, initiating rescue breathing without a barrier device is reasonable. If the victim is known to have a serious infection appropriate precautions are recommended.

## 1.8. Recovery position

There are several variations of the recovery position, each with its own advantages. No single position is perfect for all victims. The position should be stable, near to a true lateral position with the head dependent, and with no pressure on the chest to impair breathing.

## 1.9. Paediatric basic life support

Rescuers who have been taught adult BLS and have no specific knowledge of paediatric resuscitation may use the adult sequence, as outcome is worse if they do nothing. Non-specialists who wish to learn paediatric resuscitation because they have responsibility for children (e.g., teachers, school nurses, lifeguards), should be taught that it is preferable to modify adult BLS and perform five initial breaths followed by approximately one minute of CPR before they go for help (see adult BLS guideline).

When conducting a paediatrics CPR for two Technicians continuous compressions are 15 for every two breaths. This is justified because, being two rescuers, and well trained (essential requirement),

interruption of compressions will be well below 15 seconds, and what is being achieved is to increase the supply of oxygen with negligible expense of blood flow quality. This is important in the PCR of children with rare exceptions, like those that are caused by a cadre of hypoxia.

In the absence of having a resuscitative ball, the Technician ensures maintenance of the opening of the airway to undertake the recommended compressions pace and depth.

### 1.10. Paediatric basic life support sequence, according to European Resuscitation Guidelines (2010) Last updated. (Fig. 3) Press here to see graph

The following sequence is to be followed by those with a duty to respond to paediatric emergencies (usually health professional teams):

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 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.
    - Turn carefully the child on his back.

- Open the child's airway by tilting the head and lifting the chin.
  - 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 obstruct the airway.
  - If you still have difficulty in opening the airway, try a jaw thrust: place the first two fingers of each hand behind each side of the child's mandible 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 air movement on your cheek.

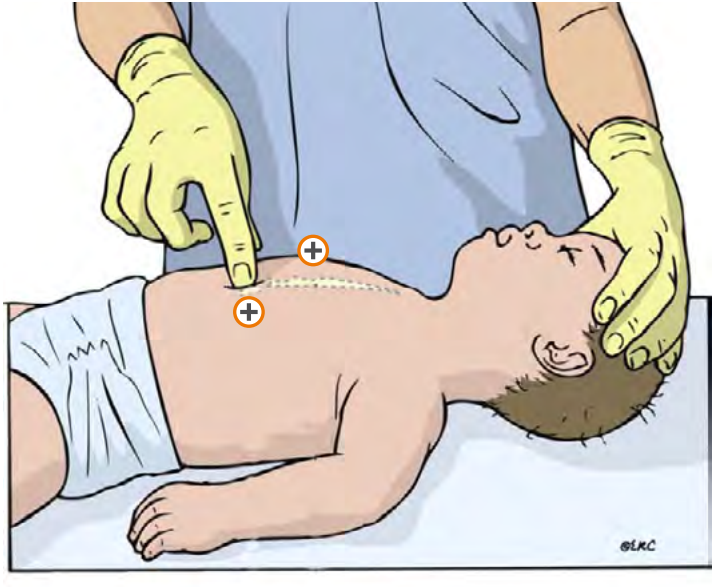
In the first few minutes after a cardiac arrest a child may be taking slow infrequent gasps. Look, listen and feel for no more than 10 s before deciding—if you have any doubt whether breathing is normal, act as if it is not normal:

5A. If the child is breathing normally:
   - Turn the child on his side into the recovery position (see below)
   - Send or go for help—call the local emergency number for an ambulance.
   - Check for continued breathing.

5B. If breathing is not normal or absent:
- Remove carefully any obvious airway obstruction.
- Give five 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 life', which will be described later.

### Rescue breaths for a child over 1 year of age:



- Ensure head tilt and chin lift.
- Pinch the soft part of the nose closed with the index finger and thumb of your hand on his forehead.
- Allow the mouth to open, but maintain chin lift.
- 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 s watching for chest 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 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.

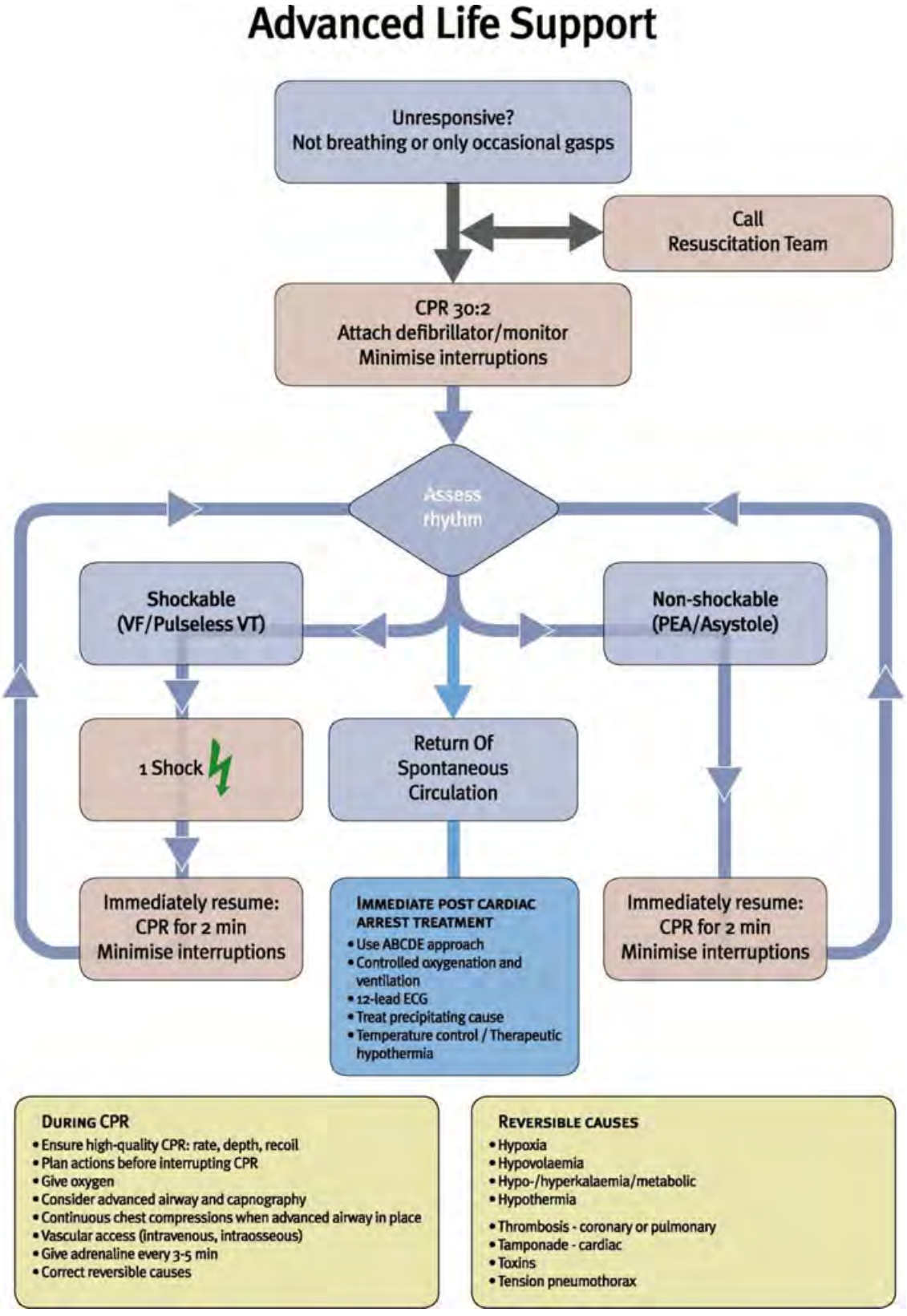
Fig. 4. Chest compression – infant

## 1.11. Electrical Cardio Pulmonary Resuscitation. Defibrillators.

Fig. 5. ALS cardiac arrest algorithm. © 2010 ERC. Press here to see graph

### 1.11.1. Automated external defibrillators. AED

Automated external defibrillators (AEDs) are safe and effective when used by either laypeople or healthcare professionals (in- or out-of-hospital). Use of an AED by a layperson makes it possible to defibrillate many minutes before professional help arrives.


Advanced Life Support
Unresponsive?
Not breathing or only occasional gasps
Call
Resuscitation Team
CPR 30:2
Attach defibrillator/monitor
Minimise interruptions
Assess rhythm
Shockable
(VF/Pulseless VT)
Non-shockable
(PEA/Asystole)
1 Shock
Return Of
Spontaneous
Circulation
Immediately resume:
CPR for 2 min
Minimise interruptions
IMMEDIATE POST CARDIAC ARREST TREATMENT
• Use ABCDE approach
• Controlled oxygenation and ventilation
• 12-lead ECG
• Treat precipitating cause
• Temperature control / Therapeutic hypothermia
Immediately resume:
CPR for 2 min
Minimise interruptions
DURING CPR
• Ensure high-quality CPR: rate, depth, recoil
• Plan actions before interrupting CPR
• Give oxygen
• Consider advanced airway and capnography
• Continuous chest compressions when advanced airway in place
• Vascular access (intravenous, intraosseous)
• Give adrenaline every 3-5 min
• Correct reversible causes
REVERSIBLE CAUSES
• Hypoxia
• Hypovolaemia
• Hypo-/hyperkalaemia/metabolic
• Hypothermia
• Thrombosis - coronary or pulmonary
• Tamponade - cardiac
• Toxins
• Tension pneumothorax

### 1.11.2. Sequence for use of an AED

1. Make sure you, the victim, and any bystanders are safe.

2. Follow the Adult BLS sequence:
   - if the victim is unresponsive and 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 alert the ambulance service – leave the victim only when there is no other option.

3. Start CPR according to the adult BLS sequence. If you are on your own and the AED is in your immediate vicinity, start with applying 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 electrode pads are being attached to the chest;
   - follow the spoken/visual directions 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 shock button as directed;
   - immediately restart CPR 30:2;
   - continue as directed by the voice/visual prompts.

5b. If no shock is indicated:

- immediately resume CPR, using a ratio of 30 compressions to 2 rescue breaths;
- continue as directed by the voice/visual prompts.

6. Continue to follow the AED prompts until:

- professional help arrives and takes over;
- the victim starts to wake up: moves, opens eyes and breathes normally;
- you become exhausted.

At best, standard manual CPR produces coronary and cerebral perfusion that is just 30% of normal. Several CPR techniques and devices may improve haemodynamics or short-term survival when used by well-trained providers in selected cases. However, the success of any technique or device depends on the education and training of the rescuers and on resources (including personnel).


fig. 6. Desfibrilador FRx de Philips

fig. 6.

fig. 7.

fig. 8.

fig. 9.

fig. 10.