# Basic Life Support (BLS) and automatic external defibrillation

The study will present guidelines regarding techniques used during the initial resuscitation of adults and children who suffered from cardiac arrest. The guidelines for basic resuscitation procedures relate to: clearing the airway, ventilation and chest compressions and the use of an Automated External Defibrillator (AED). The entire material has been prepared on the basis of the current guidelines of the Polish Resuscitation Council 2015, available at www.prc.krakow.pl.

According to the latest guidelines, a very important factor increasing survival in out-of-hospital cardiac arrest is the relationship between the action of a medical dispatcher and a witness of an event performing cardiopulmonary resuscitation (CPR) and the appropriately fast use of the AED device (Fig. 1).



Figure 1: Interaction between a medical dispatcher, a witness performing CPR and the rapid use of AED as a primary factor in improving survival in an out-of-hospital cardiac arrest. Based on the guidelines of the Polish Resuscitation Council.

In addition to the rapid disposition of the first responders team, the dispatcher's role in the early diagnosis of cardiac arrest and in giving instructions by telephone to the witness of the event on how to conduct CPR is emphasized. The dispatcher also has the ability to locate the nearest AED, which can reduce the time of its application at the scene.

In the case of eye witnesses, their knowledge, skills and behaviour will vary depending on the circumstances, level of training or previous experiences.

If the witness of the incident is properly trained, the guidelines recommend assessing the injured person as soon as possible, determining whether he or she is unconscious and breathing correctly so as to call the emergency medical team immediately. In the case of an injured person who is unconscious and does not breathe properly, cardiac arrest should be recognized and CPR should be started.

Cessation of blood flow through the brain can lead to convulsions that may be mistakenly assessed as an epileptic attack. Therefore, in a victim with convulsions always suspect cardiac arrest and carefully assess whether he or she is breathing properly.

Current guidelines indicate that high-quality cardiopulmonary resuscitation is a key factor in improving survival. Persons conducting CPR should compress the chest to a depth of at least 5 cm, but not deeper than 6 cm. The frequency of compressions should be 100-120 / min. It should be remembered to allow the chest to return to its original shape (chest relaxation) after each compression and to minimize interruptions in chest

#### compressions.

When performing rescue breaths, remember that breathing in does not last longer than 1 second, while the volume of inhaled air should cause visible rise of the chest. The pause in chest compressions due to ventilation should last no more than 10 seconds. The ratio of chest compressions to ventilation is 30: 2.

#### Chain of survival

The survival chain is a concept that combines the most important activities necessary for effective resuscitation (Fig. 2).



#### Figure 2 Survival chain. Based on the guidelines of the Polish Resuscitation Council.

Early assessment and calling for help

If we are witnessing someone reporting a chest pain, we should always treat this symptom as myocardial ischemia. In this situation, you should immediately call the emergency medical team. The arrival of an ambulance before the victim loses consciousness significantly increases his or her chances of survival. In a situation where the injured person does not move, it is necessary to examine the reaction to stimuli as soon as possible and assess the breathing. Lack of response and lack of proper breathing are the basic symptoms of cardiac arrest. In the event of cardiac arrest, it is important to recognize it quickly, notify the emergency medical system and start CPR quickly. Cooperation with a medical dispatcher may speed up the process of diagnosing cardiac arrest.

Early commencement of CPR by witnesses of the event

According to current guidelines, the immediate commencement of CPR increases the chances of survival up to four times. A witness performing CPR should, if he or she is able to, perform chest compressions together with rescue breaths. If the witness is not a trained person, the medical dispatcher should instruct him or her on how to perform chest compressions only until the victim is taken over by the emergency medical team.

# Early defibrillation

Defibrillation performed within 3-5 minutes after the loss of consciousness can ensure survival in up to 70% of the injured. Early defibrillation by accidental helpers is possible thanks to the AED device. That is why various types of AED distribution programs are spread in public places.

Early advanced resuscitation procedures based on a standard post-resuscitation care protocol

If the injured does not regain consciousness despite resuscitation, it will be necessary to implement advanced resuscitation procedures. In practice, they will be implemented by professionals and do not apply to witnesses providing first aid.

# Diagnosis of cardiac arrest

Cardiac arrest should be suspected in people who are unconscious and not breathing properly. Diagnosis of cardiac arrest can be difficult. According to current guidelines, checking the pulse is an ineffective method of confirming the presence or absence of blood circulation, so in the case of BLS, the witness is not obliged to check the pulse of an unconscious person. During the first few minutes of cardiac arrest, agonal breaths may appear. These are slow deep breaths, often accompanied by snoring. They are associated with brainstem activity, which can continue to function for several minutes despite a lack of oxygen, and can be mistaken for normal breathing. Agonal breaths should be considered as abnormal breathing, which is a sign of cardiac arrest. Starting CPR in people with agonal breathing results in higher survival. Changes in the appearance of the skin, such as bluish tinge or pallor, are not considered criteria for diagnosing of cardiac arrest.

#### BLS algorithm in adults

The sequences of the subsequent steps for dealing with an unconscious person are shown in Figure 3.



#### Figure 3.

This is a simplified diagram whose purpose is to focus only on the most important activities. Presenting individual steps in such a concise and logical manner means that everyone can learn, remember and use them when providing assistance to the injured party. The algorithm will be presented in more detail below.

# 1. Security.

Ensure the safety of yourself, the injured person and the witnesses of the incident. First, we assess the place of the incident and try to properly secure it. We will behave differently on a busy road and differently in a room where we suspect, for example, electric shock. When deciding to help the injured person, we must be sure that we are not exposed to danger.

# 2. Checking reaction of the injured

One should approach a lying person and first ask from a distance "Are you alright?", "Do you hear me?" etc. If the injured does not respond, the witness should kneel, gently shake the injured person's shoulders and ask again loudly "Is everything okay?". If the injured reacts, it is best to leave him in the same position as long as the situation is safe. It is worth finding out what had happened and if any help is needed. While waiting for help, check the condition of the injured person regularly. If there are other witnesses present, this is the optimal moment when we indicate a person to help.

# 3. Respiratory tract

#### Airway patency

If the injured does not respond, assess breathing. To do this correctly, it is necessary to clear the airways. To do this, place the injured on his or her back, then place his or her hand on the forehead and gently bend the head back. The fingertips of the other hand should be placed under the lower jaw and then raise the jaw. In this way, the airways will be properly opened (Fig. 4). It is not recommended that the witness of the event scoop the mouth with their finger.



#### Figure 4.

#### 4. Breathing.

Should be judged by sight, hearing and feeling.

The person providing help, by keeping the airway open, should lean over the injured person's head and try to assess the following elements: does he/she see the movement of the chest rising, does he/she hear air flow in the respiratory tract and does he/she feel a blow of air on his/her cheek. The breath assessment should last no longer than 10 seconds. If the injured person is not breathing properly at this time or the person checking the breath is in doubt as to whether the injured person is breathing correctly,

prepare for CPR. Sometimes people with cardiac arrest experience slow and loud agonal sighs. It's important not to mistake agonal breathing for proper breathing.

# 5. Does not respond and does not breathe properly. Call the emergency team.

If there are other witnesses at the scene of the accident and it is possible, the emergency medical team (phone number 999 in Poland) should be called by a person designated earlier for help. Otherwise, the person providing first aid makes a phone call before starting CPR. When making a phone call, you should not leave the injured unless it is not possible. To facilitate the exchange of information with the dispatcher, you need to activate the speakerphone feature on your phone.

# 6. Send someone to bring an AED

If the person providing assistance is alone, he / she should immediately start CPR. However, if there is someone to help, they should be sent to find and bring an AED, if available.

# 7. Circulation, chest compressions

When performing chest compressions, it is most convenient to kneel at the side of the injured person. The first step is to place the wrist of one hand in the middle of the injured person's chest, i.e. in the lower half of the sternum (Fig. 5-1). Next, put the other wrist on your hand and braid the fingers so as not to compress the ribs of the injured (Fig. 5-2). During compressions, the arms must be straight and perpendicular to the chest (Fig. 5-3).

# Proper Techniques for Chest Compressions.



## Figure 5.

Care must be taken not to compress the upper abdomen and the lower edge of the sternum (the xiphoid process). The middle of the chest is compressed to a depth of about 5 cm, but no deeper than 6 cm. The frequency should be 100 - 120 compressions per minute.

If the person providing assistance is not trained or cannot perform rescue breaths, he / she should conduct CPR only by constantly compressing the chest.

# 8. Rescue breaths

When a CPR performer is trained and able to, the guidelines recommend combining chest compressions with rescue breaths. In this situation, after 30 compressions, one should open the airways again (head bend, jaw lift) and perform 2 rescue breaths. When performing mouth-to-mouth breaths, remember about your own safety. It is worth having special foil masks with a filter (included in car first aid kits, you can buy them in stores) that protect against secretions of the injured (Fig. 6). There are also special masks (Pocket Mask) (fig. 7) that are even more effective.

When preparing for rescue breaths, remember to keep everything tight. In the mouth-to-mouth technique (with or without a foil mask), the thumb and the forefinger of the hand resting on the forehead should be pressed on the wings of the injured person's nose. Inhale is done by blowing the volume of air for 1 second, while observing whether the injured person's chest rises. Chest rising indicates effective rescue breaths.

After the first breath, we perform the second one in the same way. The pause in chest compressions should not last longer than 10 seconds. If rescue breaths are not effective or there is a problem with their execution, the person performing CPR should return to chest compressions after 10 seconds.



Figure 6



Figure 7.

# Chest compressions and rescue breaths should be continued at a 30:2 ratio.

#### 9. When the AED arrives

Start the AED device as soon as possible and follow its instructions.

#### 10. AED is not available

The witness should still continue CPR until:

- Professional help appears and a decision is made that CPR can be interrupted
- The injured person will show signs of life: his / her breath will return, he /she will start moving, open the eyes, etc.
- The witness will be exhausted
- The situation will start to threaten the witness

#### AED

The idea of AED defibrillators is that these are devices that any person, even without medical education, will be able to handle. They are relatively cheap, so you can afford to distribute them in public places. Depending on the manufacturer, the AED body has a button that turns on the device (some models start automatically when removed from the case), a defibrillation button may also be available. AED handling comes down to starting the device and executing its commands. Each AED has pre-loaded message sequences.



Figure 8.

1. The first message after starting is the "stick electrodes and connect the plug" message. The electrodes are marked with drawings (Fig. 8) on how to stick them, the plug is often marked with a blinking light. When sticking electrodes on, three special situations are considered:

- If the injured person has a profusely hairy chest, shave it (there should be a razor in the AED case). If there is no razor, then two sets of electrodes should be available, excess hair should be removed by sticking and tearing off the first set of electrodes and then stick the second set to shaved places.
- The injured person has a wet chest. In this situation, collect excess water with a cloth. The chest does not have to be perfectly dry. If the injured person is in a puddle, water he or she should be moved to the dry ground.
- An implanted pacemaker / cardioverter is visible under the left collarbone. Such devices are visible as a pronounced protrusion under

the skin. In this situation, do not stick the electrode directly on the device (it is usually glued below the protuberance on the skin).

2. After sticking the electrodes, the device will start analyzing your heart rate. Then the message "analysis in progress, do not touch the injured" will appear. During this time CPR should be stopped, you should not touch the injured and wait for further instructions.

3. If the message "recommended discharge" appears, it means that defibrillation will be required. At this time, move away from the injured person, make sure that no one else is touching him / her. If it secure the witness presses the (most often flashing) Defibrillation button: Some AED models defibrillate themselves, displaying safety messages beforehand. If the message "discharge not recommended, if necessary, continue CPR" appears, you should start cardiopulmonary resuscitation as soon as possible at a 30:2 ratio .

4. After unloading / or not performed, the device will give a message to continue CPR. You should then resume compressions and breaths at a 30:2 ratio and carry on with it till next message "analysis in progress, do not touch the injured". In this way the loop will repeat.

According to the guidelines, the cycle between consecutive cardiac analyzes lasts two minutes. In some AED models, a metronome appears, giving a sound signal to help maintain the correct rate of compressions and telling you to provide breaths. After each rhythm analysis, if possible, persons making chest compressions should change. The AED device works until the emergency medical team arrives. It is also good to remember how many discharges there were before the ambulance appeared.

All material was prepared on the basis of the 2015 Resuscitation Guidelines of the Polish Resuscitation Council, available on the website

www.prc.krakow.pl.