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# DAN BASIC LIFE SUPPORT & AUTOMATED EXTERNAL DEFIBRILLATION (BLSD)

Student book / EN

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# DAN BASIC LIFE SUPPORT & AUTOMATED EXTERNAL DEFIBRILLATION

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# Table of Contents


DAN BLS(D) 1

Basic Anatomy and Physiology 4

1. A-Airway 4
2. B-Breathing 5
3. C-Circulatio 5

Chain of survival 7

1. Early Access to the EMS 7
2. Early BLS 7
3. Early defibrillation 8
4. Early Advanced Life Support 8

Basic Life Support 11

1. What is BLS? 11
2. Why BLS? 12
3. Alerting the Emergency Medical Services (EMS) 13
4. Emotional stress and fear of doing the wrong thing… 14
5. Legal aspects 15
6. BLS guidelines 15

Scene Safety Assessment 17

1. Danger and Cross Infection 17
2. Cross Infection 17

Resuscitation - CPR 22

1. Cardio Pulmonary Resuscitation (CPR) 22
2. Compressions – Ventilations Ratio 22
3. Gastric Distention – Regurgitation 23
4. Adult Resuscitation sequence – Actions of the rescuer explained 24
5. Approach – Assessing responsiveness – Opening Airway 24
6. Assessing breathing 25
7. Starting CPR – Support Circulation 25
8. What about children? 26
9. The use of Face shield and Resuscitation masks 27
10. Early defibrillation – The need for an AED 28

Recovery Position 36

Foreign-Body Airway Obstructions (FBAO) 39

1. Removing foreign matter from the mouth 40

Control of external bleeding 44

1. Using hemostatic dressings/tourniquet 45

Shock management 48

1. What is shock? 48
2. Why does extreme fluid loss might lead to shock? 49
3. What to do? 49

Automated External Defibrillation - Sudden Cardiac Arrest 53

1. Sudden Cardiac Arrest - Is This Serious? 53
2. Warning Signs of Sudden Cardiac Arrest 53
3. What Happens During Sudden Cardiac Arrest? 54
4. Defibrillation — The Treatment for Ventricular Fibrillation (VF) 56
5. Who Can Provide Defibrillation? 57
6. What About CPR? 58
7. You should continue to provide CPR: 59
8. Providing Emergency Care 59

Regulatory Issues 71

Additional information 73

1. First aid courses & refresher training 73
2. Moving an injured Person 73
3. Other techniques 74
4. The use of a stabilisation board 74
5. Spinal Injury Management 75
6. Log Roll 75
7. Home Emergency Plan 76
8. First Aid Kits 76

Divers Alert Network 78

BLS/BLSD Review Questions : Answers 79

Home Emergency Plan 81


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# DAN BLS(D)

## Course Overview

The DAN BLS (D) programme is designed to teach you the skills and knowledge needed to perform Basic Life Support (BLS) or the BLSD (using an Automated External Defibrillator (AED).

## Knowledge Development

The Knowledge Development portion of this course is designed to provide information that will allow you to:

1. Understand basic Anatomy and Physiology
2. List the 4 links of the “chain of survival”
3. Protect yourself against disease transmission and danger
4. Check responsiveness
5. Check for normal breathing
6. Perform chest compressions and rescue breathing – CPR
7. Provide care for choking
8. Place an unconscious injured person in the recovery position
9. Provide care for external bleeding (optional)
10. Provide care for injured persons in shock (optional)
11. Recognition of signs for Sudden Cardiac (only for BLSD)
12. Perform Basic Life Support with an AED (only for BLSD)
13. Know how to perform regular maintenance of an AED (only for BLSD)

You will attend a lecture provided by your DAN BLS (D) Instructor. This lecture supports the information presented in this handbook. The handbook supplies information in a simple, easy-to-understand manner. At the end of each section, review questions are provided to help you assess your comprehension of the material previously covered.

## Skills Development

The skills development portion of the course will give you an opportunity to perform BLS (D) skills, under the guidance of a DAN BLS (D) Instructor. This handson part of the course is designed to have you apply what you have learned in the knowledge development part of this course.

## Assessment and Certification

Upon completion of the DAN BLS (D) course, you will receive a DAN BLS (D) Provider certification card indicating that you have been trained to provide BLS o BLSD.

## Prerequisites

There are no prerequisites to this course. BLS however is a prerequisite for many other First Aid or Rescue courses.

## Learning Objectives

At the end of this programme you will be able to:

1. Performing a Scene safety assessment
2. Pratice CPR with a single responder to a person who is not breathing
3. Placing an unconscious breathing person in the recovery position
4. Providing care for a person with a foreign body airway obstruction (chocking)
5. Providing care for (severe) external bleeding (optional)
6. Providing care for shock (optional)
7. Recognize the warning signs of a heart attack (only for BLSD)
8. Providing care with an AED (only for BLSD)

## Refresher training

The “DAN BLS / BLSD Provider” license is valid for 2 years. Refresher training should be carried out every 2 years. However, more often is recommended for this kind of training programme.

**Remark**

Although this book will positively influence the learning process before and during a BLS (D) course, the book only will not train you as a BLS (D) provider.

In order to be able to perform the techniques described in this book you must participate in a BLS (D) course, organised by a qualified and active BLSD Instructor.

This book is also a valuable resource for after a BLS (D) course.

This manual is made according to the 2015 ERC Guidelines for  BLSD.


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# Basic Anatomy and Physiology

**Note**

All information presented in the following sections is based on the most recent diving medical literature. References are available from your DAN Instructor or the DAN Training Department in your region.

**Airway – Breathing - Circulation**

Air contains about 21% of oxygen and about 79% of nitrogen.

Our body (cells, organs, etc) needs a constant supply of oxygen in order to produce energy / to survive. This can be compared with the function of fuel in a car.

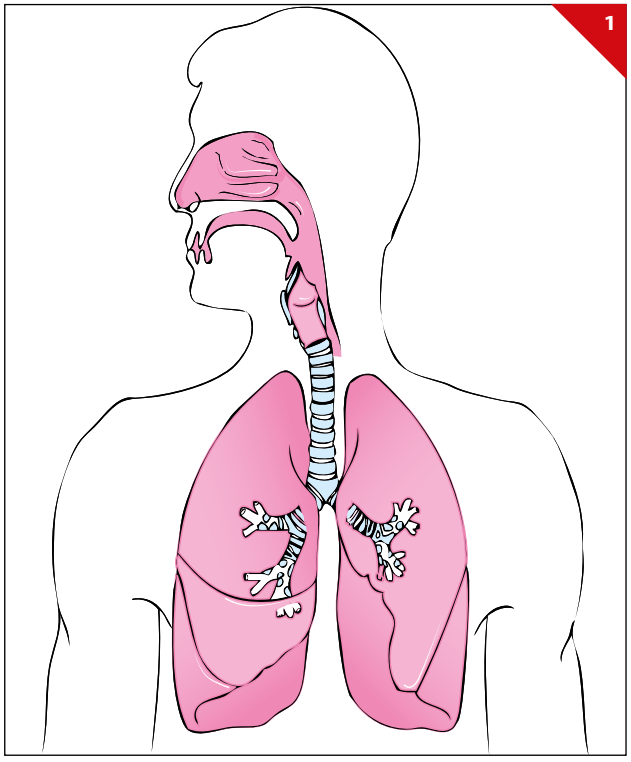
Without this constant supply (and transport) of oxygen to the body, organs and cells will deteriorate and die.

## 1. A-Airway:

An open Airway (nose, mouth and trachea) makes sure air can pass to the lungs (Pic. 1).

**Remark**

The oesophagus, the tube that carries food from the mouth to the stomach, is just behind the trachea (windpipe) and the larynx. The openings of the oesophagus and the larynx are very close together in the throat. When we swallow, a flap called the epiglottis moves down over the larynx to keep food and liquid out of the windpipe.




Pic. 1:
An open airways makes sure air can pass to the lungs

## 2. B-Breathing

Each time we inhale (breathe in), air goes into our nose or mouth, then through the larynx, down the trachea or windpipe.

The windpipe divides itself into a left and right bronchus and air enters via these bronchi in respectively, the left or right lung. These bronchi are like branches, dividing themselves into smaller branches or bronchioles. At the end of the bronchioles the air arrives in small air sacs. These tiny sacs are called alveoli.

There are about 300 million alveoli in the lungs and every alveolus is surrounded by capillaries (tiny blood vessels with very thin walls).

Oxygen (from the air) goes from the alveoli through these thin walls to the capillaries. This process is called diffusion.

In these capillaries we also find carbon dioxide (CO2). This is the waste product of the body's metabolism (used oxygen returns to the lungs under the form of CO2).

This Carbon dioxide diffuses from the capillaries back to the alveoli.

The diffusion of oxygen to the blood is only possible when the concentration of oxygen in the lungs is higher than the concentration of oxygen in the capillaries. By breathing in we make sure the oxygen concentration in the lungs remains higher.

When we exhale (breathe out), the air (with an increased CO2 concentration), goes out of the lungs and is transported via the bronchi and windpipe to the mouth or nose where it leaves the body.

## 3. C- Circulation

The heart pumps the oxygenated blood (from capillaries) around and transports it to all parts in the body.

This is done by the pulmonary (to and from the lungs) and systemic (rest of the body) circulation.

Deoxygenated blood returning form the systemic circulation (containing CO2) enters the right atrium, goes to the right ventricle and is pumped to the lungs for gas exchange in the alveoli (pulmonary circulation).

Blood that returns from the lungs enters in the left atrium, is transported to the left ventricle and from there it is pumped to the rest of the body (via the systemic circulation).

This blood will carry the oxygen to the body cells until it arrives back to the right atrium.

**Medical terminology.**

**Atrium —** Chamber of the heart that provides access to another chamber called the ventricle.
**Larynx —** The organ of voice production; also known as the voice box.
**Pharynx —** Portion of the airway connecting nasal cavity and larynx.

# Section 1

## REVIEW QUESTIONS

1. **The body needs a constant supply of oxygen in order to survive.**
   - **a.** True
   - **b.** False

2. **In order to make sure air can pass to the lungs, the _____ must be open.**
   - **a.** Airway
   - **b.** Mouth only

3. **The epiglottis prevents food and liquid from entering the _____.**
   - **a.** Stomach
   - **b.** Heart
   - **c.** Trachea
   - **d.** Oesophagus

4. **Gas exchange takes place in the _____.**
   - **a.** Arterioles
   - **b.** Aorta
   - **c.** Alveoli
   - **d.** Atrium

5. **The _____ pumps the oxygenated blood around and transports it to all parts in the body.**
   - **a.** Stomach
   - **b.** Heart
   - **c.** Muscles
   - **d.** Liver

**Review answers are on pag 79**

# Chain of survival

There are 4 steps that positively influence the chance of survival. These 4 steps are commonly referred to as the 4 links in the chain of survival.

## 1. Early Access to the EMS

Calling an ambulance or trained health-care providers is essential in order to increase the chance of survival (Pic. 2).
It is therefore important to recognise the problem as soon as possible to avoid time getting lost. It is important that the person alerting the ambulance is calm and as clear as possible.

Tell the ambulance dispatcher:

- The exact location of the emergency
- What happened
- How many injured persons
- The condition of the injured person(s)
- The care provided


Pic. 2:
Call for help is essential in order to increase the chance of survival

In order to make sure that the person you asked to call for help activated the ambulance service you should ask him to return immediately after the call.

It is also recommended to have the caller repeat the needed info before having him leave to call for help. That way you can correct him if needed and are making sure the message will be correct.

Keep in mind that the sooner you make the call, the sooner Advanced Life Support (ALS) will arrive.

## 2. Early BLS

Early BLS significantly improves the chance of survival (Pic. 3).

During BLS or CPR we try to avoid damage to the vital organs by circulating oxygenated blood.

Chest compressions temporary taking over the function of the heart, by “manually” pumping around the blood in the body.

Rescue breaths deliver air (oxygen) to the lungs and are making sure there will be a gas exchange in the alveoli.


Pic. 3:
Start BLS as soon as possible

## 3. Early defibrillation

In most cases the reason why a per-sons stops breathing is a cardiac arrest.

Cardiac arrest is often caused by “Ven-tricular Fibrillation –VF”.

This is an electrical disturbance of the heart, which makes the heart muscle quivers and creates an abnormal chaotic rhythm.

Due to the absence of the normal electrical impulse, the heart is no longer pumping effectively.

In these cases CPR would not restart the heart. While CPR would delay (brain or other) damage because of the lack oxygen, only a defibrillator could be able to revert the rhythm and make the heart beating again (Pic. 4).

It is therefore crucial to defibrillate a person with Sudden Cardiac Arrest as soon as possible (ideally within 4 - 5 minutes).

After 7-10 minutes the chance of survival will be minimal.

## 4. Early Advanced Life Support

BLS and defibrillation might not restart the heart. In those cases, medical interventions like advanced airway management and the delivery of medications might increase the success of resuscitation (Pic. 5).

Should BLS and/or defibrillation be successful, advanced Life Support will stabilise the injured diver and make him ready for transportation to the hospital.

Remember: Advanced Life Support will not arrive when the ambulance is not called!


Pic. 4:
If trained in it, use an AED


Pic. 5:
Advanced airway management increases the success of resuscitation

# Section 2

## REVIEW QUESTIONS

1. **What are the 4 links in the chain of survival (in correct order)?**

2. **During early BLS, _____ temporary taking over the function of the heart, while _____ deliver oxygen to the lungs.**

**Review answers are on pag 79**

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# Basic Life Support

## 1. What is BLS?

BLS is a total of first aid techniques used to support (or restore) life and include:

- Protecting yourself
- Activation of the Ambulance
- Provide care for life threatening injuries
- Establishing or maintaining ABC's (performing CPR - Pic. 6).

To be able to provide care for life threatening injuries it is crucial to learn these basic First Aid techniques:

- Scene Safety Assessment (and personal protection)
- CPR (Cardio Pulmonary Resuscitation)
- Recovery Position
- Foreign-body Airway Obstruction / Choking
- (Severe) External Bleeding
- Shock Management

In order to guarantee the best possible care to an injured person it is important to keep BLS skills and knowledge up-to-date.

Regular refresher training or participation in more advanced first aid courses, like an AED or oxygen provider course, is recommended and encouraged.


Pic. 6:
Chest compressions circulate blood throughout the body

## 2. Why BLS?

It is vital that the oxygen supply to our organs is maintained.

The supply of oxygen to our organs is achieved when:

1. We have an open and clear **Airway**. Obstructions in the airway (or a closed airway) will block the air supply to our lungs.
2. We keep on **Breathing** so the inhaled air goes from the airway to the lungs and oxygen can diffuse to the blood stream.
3. The oxygen in the blood vessels is transported from the lungs to the body tissues. This is done thanks to the heart which takes care of the **Circulation** of the blood throughout our body.

When this supply is interrupted our organs will suffer and eventually die. Brain tissue will for example already start to die after 3-6 minutes without oxygen.

The need for immediate action (Basic Life Support - Resuscitation) is therefore crucial.

During Basic Life Support the rescuer takes care (establishing or maintaining) of the above mentioned Airway, Breathing and Circulation, commonly referred to as the **ABC's** or vital functions.

When performing CPR or resuscitation (main part of BLS) we:

1. Check for responsiveness.
2. Open the Airway (or maintain an open airway) and check for normal breathing.
3. Provide chest compressions in order to temporary take over the function of the heart and pump the blood around as soon it has been confirmed the injured person is not breathing normally.
4. Pive rescue breaths in order to deliver air (oxygen) to the lungs.

The goal of resuscitation is not to restart the heart, but to provide a small but critical blood flow to the heart and brain, thus keeping oxygenated blood circulating.

Indeed, in most cases CPR will not restart the heart, but delays damage to vital organs (such as the brains) and buys time.

It also increases the chance on a successful defibrillation (chest compressions are especially important if a shock can not be delivered within 4-5 minutes after collapse).

**Note**

The air we use during rescue breathing is our expired air and does not contain 21% oxygen anymore, but only 16-17%.

For a better oxygenation of the blood it is recommended to use supplemental oxygen during resuscitation (if trained in it).

Techniques of providing oxygen to non breathing persons (divers) are seen in the DAN Oxygen and Advanced Oxygen Provider course.

The goal of BLS is to:

- Preserve Life
- Prevent further injury
- Provide first aid and basic stabilisation of the victim until the arrival of the ambulance. This might have a positive influence of the victim's recovery process

BLS is not limited to CPR, and the other first aid techniques seen in the DAN BLS course might prevent a person from having a circulatory (and / or respiratory) arrest and can save lives. A BLS course will not only train a rescuer to resuscitate a person with a circulatory arrest, but can also prevent a person from getting in that condition. External bleeding and shock for example can lead to severe circulatory and respiratory problems.

## 3. Alerting the Emergency Medical Services (EMS)

Many times underestimated, but not less important is calling the EMS: The EMS should be called from the moment you have established a person is breathing or not. If you are alone, you will need to activate the EMS before CPR is started. If you are not alone, you can send somebody for help while starting CPR.

An exception to this rule is when the victim is:

- A child or
- A victim of drowning

In many countries the EMS can be reached by dialling 1-1-2 (depending from the country) or a similar national emergency number. It might be possible that you are asked which kind of emergency service you would like to talk to (police, fire department, EMS).

When calling the EMS, the caller should be calm and clearly state:

- His name
- What happened: what is the emergency and the condition of the victim
- How many victims are involved
- The first aid provided
- The location of the emergency

If you are he rescuer at the scene of an accident it is recommended to give one of the bystanders clear instructions that he should call the EMS and ask him to come back. This way you have an idea how long it will last before the ambulance would arrive and you are sure the EMS was activated. It might be a good idea to ask the caller to repeat the info you gave him, to make sure the info he will give to the EMS is correct.

# 4. Emotional stress and fear of doing the wrong thing…

Helping others in need gives you a good feeling, but it might also create emotional stress before, during and after the rescue. When a person is the victim of an accident or of a sudden cardiac arrest it is not uncommon that bystanders are waiting until somebody else stands up and provide first aid.

Hesitating to step forward and start BLS is often caused by:

- Fear of not being able to provide the best possible care, doing something wrong, causing harm or not being able to bring back life
- Fear of being sued
- Fear of infection (in the next section you will learn how to avoid infection)

Anxiety is normal when providing first aid. The rescuer and injured person are both in a stressful situation and the rescuer might consider not to provide care, so he doesn't have to take the risk of making any mistakes or not being able to provide perfect care.

It is however OK not to provide "perfect" care. A small mistake will rarely result in an injury or getting the victim into a worse condition. A small mistake while providing care is much better than no mistake but not providing care at alla.

Keep in mind that when a rescuer would not react the victim's condition will surely stay the same or get worse. A person with a circulatory arrest (no signs of life) is in the worse possible condition. When providing CPR you can impossibly make that condition worse. The fear of causing harm is thus irrelevant and overestimated. After being certified as DAN BLS provider you can be confident you are able to provide BLS in a good and effective way and when you step forward to provide care you will be surprised how clearly the needed first aid skills will come back in your mind. To keep this level of competence it is required to refresh your knowledge at least once every 2 years, by following a BLS refresher course.

The rescuer might also have an increased heartbeat and can be a bit shaky when providing first aid. This is a natural reaction from the human body (adrenaline) and actually help us to step forward and provide first aid. After providing care and when the rescuer relaxes (by for example walking a bit), he will feel his heartbeat coming back to normal and calm down.

It is however important that the rescuer doesn't show that he is anxious, as this would only make the victim nervous and more stressed. Injured persons might react very strange, going from anger to violence. A rescuer should try to keep as calm as possible and talk to the injured person, informing him what he is doing and calming him down.

Unsuccessful rescues might also create a severe emotional stress to the rescue. This rescuer might blame himself for not "saving" (bringing back) a life and/or think he did something wrong. It might be appropriate to talk with the rescuer after the rescue in order to mentally support him and to let him know he did whatever was possible. Rescuers with severe emotional problems after providing first aid might need to seek professional help.

An unsuccessful rescue means that a dead (no signs of life) person stayed in that condition and not that the rescuer did something wrong, with dead as the result. It is behind any rescuer's control to bring back life.

Telling that CPR saves lives or that when CPR is performed correctly you will save a life, actually gives a wrong impression and is not entirely true. This will only make a rescuer feel worse after an unsuccessful rescue.

Remember that in most cases the heart does not restart when performing CPR, even if performed perfectly. CPR increases the chances of survival, but does not guarantee it. CPR, as part of "early BLS" is only one link in the chain of survival.

# 5. Legal aspects

## Duty of care

A duty of care is present when there is a certain person that has a responsibility towards somebody else.

It is for example an obligation that sports centres (like a dive centre) provide a duty of care towards the clients (for example divers) paying the centre for a service (or to dive). The centre should be prepared to provide first aid (care) related to the activities offered.

The same for Instructors (like sport Instructors) from whom it is expected that they are able to provide care to their students.

In most countries there is no law that tells a rescuer with no duty of care to provide first aid. Although the law might tell a citizen to provide assistance.

When a rescuer with no duty of care provides first aid he must not however try to provide first aid beyond his level of training. Should he do that he might be held responsible for causing further injury to the victim.

To avoid legal problems it is recommended to ask an injured person for his permission before you provide first aid. This can be done by saying: “My name is …… and I am a First Aid Provider. Can I help you?”

If the victim is responsive, he should give permission before care is provided. When not asking this permission or forcing care against his will, the victim might take legal action for involuntary assistance or assault. Should the victim be unresponsive the law assumes that permission is given.

# 6. BLS guidelines

BLS guidelines are established by an international scientific medical committee called “The International Liaison Committee on Resuscitation (ILCOR).

This committee exists of expert regional organisations like the Australian Resuscitation Committee (ARC), the American Heart Association (AHA) and the European Resuscitation Council (ERC).

Although ILCOR publishes international BLS guidelines, it are the regional organisations that are responsible to write their own regional resuscitation guidelines.

It is therefore possible that there are minor regional differences. This manual respects the 2015 ERC guidelines.

Guidelines also may change with time and it is possible that older books are using different / older standards.

You can contact DAN in order to find our about the latest European Resuscitation Guidelines. Ongoing refresher training makes sure you always get retrained using the most current standards.

# Section 3

## REVIEW QUESTIONS

1. **During Basic Life Support the rescuer establishes or maintains the_____.**

2. **Inhaled air contains ____% of oxygen. Exhaled air only contains _____% of oxygen. For better oxygenation of the blood it is recommended to use supplemental _____, if trained in it.**

3. **The goal of resuscitation is not to restart the _____, but to provide a small but critical _____ to the heart and brain. It keeps _____ blood circulating and avoid damage to _____organs.**

4. **The goal of BLS is to _____ life, _____ further injury and to _____ first aid.**

5. **When calling the EMS you should:**
   - **a.** Inform them about what happened and the condition of the victim
   - **b.** Tell them the location of the emergency
   - **c.** Tell them how many victims are involved
   - **d.** Tell your name and the first aid provided
   - **e.** All of the above

6. **In most cases the heart restarts after performing CPR.**
   - **a.** True
   - **b.** False

7. **To avoid legal problems it is recommended to ask an injured person for his _____ before you provide first aid. This can be done by saying _____.**

**Review answers are on pag 79**

# Scene Safety Assessment

## 1. Danger and Cross Infection

A rescuer would not be able to provide first aid if he is injured himself. Rescuer safety therefore comes first.

Before providing BLS it is important to assess the scene of the accident and to eliminate or remove any danger that might be present (Pic. 7).

Dangers can be:

- Fire
- Electricity or gas
- Traffic
- Chemicals
- Animals (even tentacles from for example a jelly fish)


Pic. 7:
Make sure the scene is safe.

## 2. Cross Infection

Although the risk of infection during first aid is minor, it is always present and the risk of transmission of viruses such as Hepatitis, Tuberculoses and the Human Immunity deficiency Virus (HIV), mostly referred to as AIDS, needs to be minimised.

For this reason rescuer safety also means protection against blood, vomit or other body fluids.

To protect yourself against these cross infections you should:

- Use disposable gloves (avoid contact with sharp objects)
- Resuscitation barriers like an oronasal resuscitation mask or face shield (Pic. 8)
- Eye protection
- Avoid contact with syringes
- Wash your hands after providing first aid (more than a simple rinse)


Pic. 8:
Oronasal Resuscitation Mask

Should the rescuer come in contact with body fluids from the victim it is recommended to have him examined by a Doctor.

The decision to use these universal precautions lies with the rescuer and might be influenced depending on the person to whom first aid is given (for example own child or complete stranger) and the availability of barrier devices.

It is recommended to have protective barrier devices present in every first aid kit or even in the glove compartment of your car.

A face shield can be as small as a key chain, but might be of invaluable importance during CPR (Pic. 9).

Do not rush when approaching the scene of an accident. Take your time to **think** and **assess** the scene to make sure your safety as a rescuer is assured.

It is recommended to get the first aid kit before assistance is given should you have no gloves or other barrier devices (immediately) available. This specially when contact with body fluids is expected.

**TIP**

Before putting on gloves, blow air in them and close the opening of the glove (pulse) making a balloon of them.

Check if the glove remains full of air to make sure the glove is intact and can be used without fear of direct contact with blood or body fluids (Fig. 10).


Pic. 9:
Key ring with face shield inside


Pic. 10:
Check if the gloves are not damaged

**And what after you have given first aid?**

Any reusable first aid materials must be cleaned and disinfected after each use.

Gloves protect a rescuer during first aid, but after first aid is given, blood (or body fluids) might be present on the gloves. It is important to avoid contact with that blood when removing the gloves.

When removing gloves take the first glove at the outside of the wrist (Pic. 11) and pull the glove towards the fingers of that hand (Pic. 12). The glove will then turn inside out. Remove the glove and use your protected hand (Pic. 13) to crumble the glove into a ball (making a fist with the gloved hand).

When the removed glove is in the palm of the still protected hand (fist), go with an “unprotected” finger inside the second glove (between wrist and glove - Pic. 14) and pull the glove towards the fingers as done before (Pic. 15).

This glove will also turn inside out and the first glove will be inside the second avoiding all possible contact with the blood or body fluids present at the gloves.

Place the gloves in an “hazardous waste” bag to avoid others having contact with the gloves. This bag can also be used for all other infected materials that have to be disposed after use (Pic. 16).

**Ventilation barriers**

The use of ventilation barriers is discussed in the following section of this book. It is however important to get theses barriers as well during the Scene Safety Assessment.






# BLS Skill - Scene Safety Assessment - Safety First

**REMEMBER S-A-F-E**

**S "Stop"**

- Stop.
- Think.
- Act.

**A "Assess Scene" (Pic. 17-18)**

- Is the scene safe?
- Is it safe to approach the injured person?
- Are there any hazard present?
- Is there anything else which might be a risk for the rescuer?

**F "Find and Locate First Aid kit" (and Oxygen and AED Unit) (Pic. 19)**

- First Aid Kits contain critical supplies such as barriers (Pic.20)

**E "Exposure Protection"**

- Use barriers such as gloves and mouth-to-mask barrier devices.
- Putting on gloves: Inspect gloves for damage
- Removing gloves:
  - Take the first glove at the outside at the wrist and pull the glove towards the fingers of that hand and turn it inside out.
  - Use the protected hand to make a ball of the glove you removed
  - Go with an "unprotected" finger inside the second glove and pull the glove towards the fingers as done before, keeping the first glove inside the second one
  - Place the gloves in an "hazardous waste" bag


17


18


19


20

# Section 4

## REVIEW QUESTIONS

1. **Which dangers can be present at the site of an accident?**
2. **Rescuers protection also means protecting against _____, _____ or other _____.**
3. **What materials can you use to protect yourself against cross infection?**
4. **After providing first aid, reusable materials must be _____and _____.**
5. **Avoid contact with the outside of your _____ when removing them after first aid has been provided.**

**Review answers are on pag 79**

# Resuscitation - CPR

## 1. Cardio Pulmonary Resuscitation (CPR)

As seen earlier in the general BLS section it is of extreme importance to start CPR as soon as possible to avoid damage to brain tissues and body organs.

The most common reason why an adult victim is not breathing is a Sudden Cardiac Arrest (SCA). The heart stopped beating unexpected and there still is a relatively high amount of oxygen present in the blood vessels, heart and brain. Ventilation is therefore initially less important than chest compressions.

In the case of asphyxial cardiac arrest (cardiac arrest after suffocation – for example in drowning) the level of oxygen in the body is drastically reduced (hypoxia), making ventilations more important.

When the victim is a child, heart problems are far less common and we might also expect a lower level of oxygen in the child's body.

For this reason the BLS protocol for children and in case of drowning is slightly different.

Cardio (heart) Pulmonary (lungs) Resuscitation is a technique that consists of chest compressions and ventilations (rescue breaths):

- Chest compressions generate a small but critical amount of blood flow to the brain and myocardium (heart) and increase the likelihood that defibrillation will be successful
- Rescue breaths will bring air to the lungs and increase the oxygen concentration in the alveoli, which will then go to he capillaries by diffusion

## 2. Compressions – Ventilations Ratio

A mathematical model suggests that a ratio of 30:2 would provide the best compromise between blood flow and oxygen delivery, but interruptions in giving chest compressions must be kept to a minimum.

Resuscitation should be continued until:

- Qualified help take over
- The victim starts to wake up: to move, opens eyes and to breathe normally
- You become exhausted

# 3. Gastric Distention – Regurgitation

Gastric distention or regurgitation is the expulsion of the content of the stomach and is caused when air enters the stomach during rescue breathing.

It is very similar to vomiting. During vomiting the content of the stomach is forced out of the stomach by muscle contraction. In the case of gastric distention, there is no muscle activity, but the increased pressure inside the stomach will push out its content. This content will flow out (not spurting or forceful as in vomiting) of the stomach into the mouth.

If regurgitation happens, the reaction of the rescuer should be to turn the victim on his side and clean the airway.

However, after cleaning the airway there is still a risk that when giving new ventilations parts of the content of the stomach are blown in the windpipe and lungs. Therefore gastric distention should be avoided at all times.

In order to avoid regurgitation, the volume of the ventilation should be kept approximately 500-600 ml (6-7 ml per kg of body weight).

Rapid and forceful ventilations can also lead to distention. This because the muscle that separates the oesophagus from the stomach (oesophageal sphincter) opens at an airway pressure of 15-20 cm H2O. When blowing too hard during ventilations, this pressure can easily be reached. This sphincter might also not function anymore in victims with cardiac arrest.

In order to avoid gastric distention you should:

- Give rescue breaths of about 1 second in duration with enough volume to make the victim's chest rise (Pic. 21)
- Avoid rapid or forceful rescue breaths
- Open the airway completely
- Allow the chest to fall back in the normal position before giving the second rescue breath
- Avoid putting pressure on the stomach
- Watch the stomach for signs of overexpansion

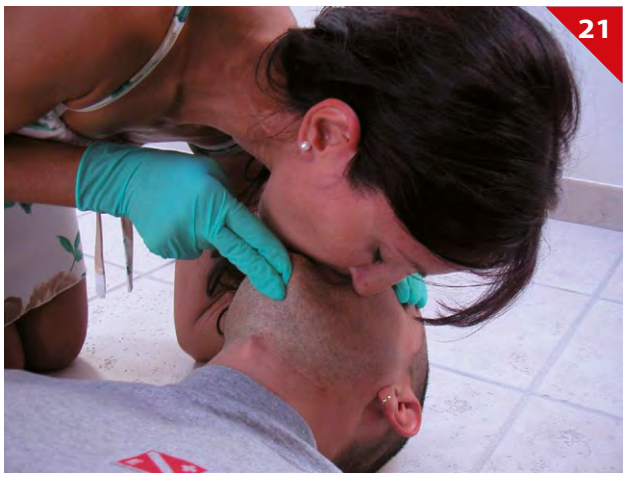



Fig. 21:
Rescue breaths

# 4. Adult Resuscitation sequence – Actions of the rescuer explained

**Note**

The exact Resuscitation techniques are described on the skills pages of this sectio.

The resuscitation sequence can be divided in 3 main parts:

- Approach, assessing responsiveness
- Assess breathing
- Start CPR, if needed

# 5. Approach – Assessing responsiveness – Opening Airway

Once a rescuer assured the scene is safe, he should assess responsiveness.

If the victim responds, he should be left in the position in which he was found and the EMS (Emergency Medical Services) should be activated.

The rescuer should reassure the injured person and try to find out what has happened.

He should introduce himself by stating his name, that he is trained to provide first aid and should express his desire to help. He should reassure the injured person by showing a carrying attitude and inform the victim about what is happening and that he is taking care of him.

The rescuer should also try to keep bystanders at a distance to avoid stressing the victim even more.

Chances are that the injured person is upset or afraid about his condition and what is happening. If the rescuer reassures him, the victim will feel safer and will keep calm.

If the injured person is not responding, he should be turned on his back and the airway should be opened immediately.

When the airway is closed, it would not only be impossible to check for breathing, but the victim would not be able to breath either.

Later in this book you will learn about Foreign body airway obstruction, but the airway can also be obstructed because of the tongue. It is possible that the tongue falls backwards and blocks the air passage when the victim has a low level of responsiveness.

Opening of the airway is done by using the head tilt-chin lift technique (Pic. 22). This is an easy to learn technique, which is described on the following pages.

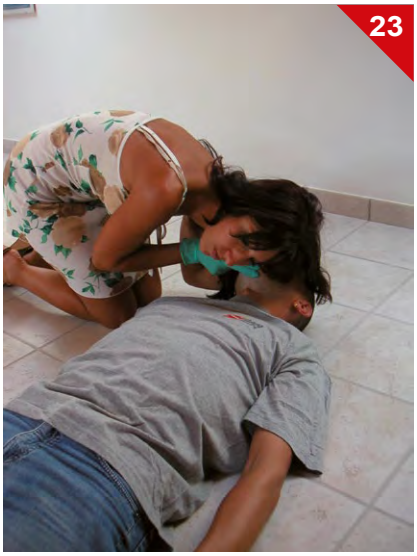
In some cases it might be enough to open the airway and keep it open until the arrival of the ambulance (when breathing is present).


Fig. 22:
Head tilt – chin lift

## 6. Assessing breathing

Once the airway is open, the rescuer should check for breathing by looking for chest movement, listing for breath sounds coming out of the mouth *(Pic. 23)*, and feeling for air movement on his cheek or ear. This is done while keeping the airway open and for no more than 10 seconds.

If normal breathing is present, the victim should be placed in the recovery position to ensure an open airway at all times and an ambulance must be called immediately.
The rescuer must check for continued breathing and should act accordingly.




Pic. 23: Assess breathing

**Important**

In the first minutes after a cardiac arrest, an injured person may be barely breathing, or taking infrequent, noisy (agonal) gasps. Do not confuse this with normal breathing. If you have any doubt whether breathing is normal, act as if not normal.

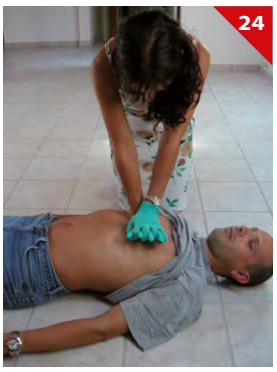
## 7. Starting CPR – Support Circulation

When breathing is absent or no normal breathing is present, the EMS should be activated immediately (inform them no normal breathing is present) and the rescuer should start chest compressions, by placing the hands with the fingers of both hands interlocked on the centre of the chest.

Current CPR guidelines request 30 chest compressions at a rate of at least 100 per minute (but not exceeding 120).

This means that for a rate of 100 per minute, the 30 compressions should be given in 18 seconds (a little less than 2 compressions a second). At a rate of 100 – not exceeding 120, this would mean 15-18 seconds. The depth of the compression should be at least 5 cm (but not exceeding 6 cm) and it is important to release the pressure on the chest between the compressions, but without loosing contact between the chest and your hands (at the sternum). The exact hand position is described in detail on the skill page.

With every compression, blood is pushed out of the left side of the heart, from where it goes throughout the body (Pic. 24). At the same time, deoxygenated blood is squeezed from the right side of the heart to the lungs, where it will take oxygen from the alveoli. When releasing the pressure on the chest, blood flows back into the right side of the heart and oxygenated blood returns from the lungs to the left side of the heart.




Pic. 24: Chest compressions


Pic. 25: Take about 1 second for each ventilation

When compressing too fast, the heart would not get the time to fill with blood and the compressions would therefore not move enough blood around, thus being ineffective.

When compressing too slow, the blood would move too slow and the blood pressure would stay too low, avoiding an effective circulation as well.

When compressions are not deep enough, the amount of blood pushed out of the heart would be minimal and inadequate to support circulation.

Immediately after these 30 compressions, the rescuer must give 2 effective ventilations.

This is done by opening the airway again, placing the mouth around the victim's mouth and closing the victims nose. The rescuer should blow air from his lungs into the mouth of the victim. Should the nose not be closed, the exhaled air from the rescuer would escape through the nose of the victim.

It is important to blow steadily into the mouth while watching the chest rise.

This should take about 1 second (Pic. 25). When the chest has returned to his normal position, the second ventilation can be given. The 2 breaths should not take more than 5 seconds in all.

When providing rescue breaths, the exhaled air from the rescuer's lungs (16% of oxygen) goes to the lungs of the victim.

If the oxygen concentration in the lungs (alveoli) is high enough, the oxygen will diffuse to the capillaries and the blood becomes oxygenated.

Obviously, during this process and because the victim is not breathing, the oxygen concentration in the lungs is getting lower. Should the concentration become too low, diffusion would sto.

To avoid this we need to give new ventilations. However, in normal conditions breathing is about 12-20 times a minute (depending from age and activity) and during resuscitation it drops to about 5 a minute.

The lower amount of oxygen in the inspired air (16% instead of 21%) and the low amount of ventilations are keeping the oxygen concentration in the lungs relatively low. By increasing the oxygen concentration during ventilations, more oxygen would diffuse to the capillaries and oxygenation would be better. Oxygen concentration can be increased by using supplemental oxygen.

**Note**

- Remove the dentures if they cannot be kept in place. In all other situation, keep them in the victim's mouth as they will make it easier to create a seal.
- If a rhythm has been restored, giving chest compressions does not increase the chance of a cardiac arrest recurring.
- Chest compressions only at a rate of 100 per minute (but not exceeding 120) may be used if the rescuer is untrained or unwilling to give rescue breaths (fear for risk of disease transmission).

## 8. What about children?

Many children do not receive resusci-tation because potential rescuers fear causing harm. This fear is unfounded; it is far better to use the adult resuscitation sequence for resuscitation of a child than to do nothing.

The following minor modifications should however be respected:

- If not breathing normally, give 5 initial rescue breaths (1-1.5 seconds in duration sufficient to make the chest rise)
- Then check for signs of life for no more than 10 seconds
- If there are signs of life, continue rescue breathing
- If there are no signs of life, start chest compressions:
  - Compress the chest by approximately one third of its depth; use two fingertips 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 (4cm for infants - 5cm for children over 1 year)
- Alone rescuer should perform CPR for approximately 1 minute before going for help unless in the case of a witnessed, sudden collapse (in this case seek help immediately).

## 9. The use of Face shield and Resuscitation masks

When giving rescue breaths it is recommended to use a resuscitation mask or face shield as protection (Pic. 26).

Face shields are easy to use and are available as keyring. The technique of rescue breathing using a face shield is the same as the technique for normal mouth to mouth ventilations.

Face shields are available with or without a protective filter. Even when both types only give a basic protection it is better to use a face shield with a filter.

When using a resuscitation mask, another technique must be used ( Pic. 27 -described later).

A resuscitation mask is a better protection then the face shield, but is also much bigger and less comfortable to carry in your pocket.

It can however be carried in a first aid kit, backpack or a glove compartment of a car.

The resuscitation mask is also called Pocket Mask (which is a brand name), although it is slightly too big to put in the pocket of trousers.


Pic. 26:
It is recommended to use a barrier during rescue breathing


Pic. 27:
Resuscitation using an Oranasal Resuscitation Mask

# 10. Early defibrillation – The need for an AED

Your body and heart have an electrical system that keeps the heart muscles contracting. As these electrical impulses fire, the muscles contract and blood flows through the arteries and veins.

When something upsets these electrical impulses and breaks the heart's rhythm a sudden cardiac arrest occurs. The most common rhythm that occurs during a SCA is called ventricular fibrillation (VF). Essentially, the chambers of your heart are no longer beating in the rhythm necessary to keep the blood flowing. They are all firing at once — the heart muscle appears to be quivering — and no blood is moving through the body.

Regardless of the cause, when the heart stops beating, if you cannot reset the heart's rhythm, the person will die. The only way to reset a heart in ventricular fibrillation is with defibrillation.

While CPR delays the inevitable by helping to oxygenate blood and circulate it throughout the body, CPR cannot reset the heart rhythm and make it start beating again. Only defibrillation can do that.

Defibrillation sends an electric shock through the heart and essentially hits a “reset” button. The electrical shock does not tell the heart how to beat or contract. What it does is scramble all of the misfiring signals and stop all of the electrical activity. The heart stops for a moment, and the body's natural pacemaker begins firing again, restoring a normal rhythm.

When defibrillation is provided within the first few minutes after VF begins, the person has a very high chance of survival.

Until recently, it required a tremen-dous amount of training to operate a defibrillator. You had to understand the heart rhythms (ECG interpretation) on the monitor before you could administer a shock. If the person wasn't already in ventricular fibrillation when you applied the shock, you could put him there. The necessary training required made defibrillators the domain of medical professionals. Doctors and nurses could use them in the hospital, or paramedics could use them at the scene of an emergency. Unfortunately, survival rates drop by about 7 to 10 percent every minute a person is in ventricular fibrillation. Long response times from emergency medical services professionals decrease the effectiveness of defibrillators in the field.

Defibrillation technology has evolved to give us Automated External Defibrillators (AEDs) which simplify defibrillation operation and greatly reduce the training needs to use a defibrillator (Pic. 28).

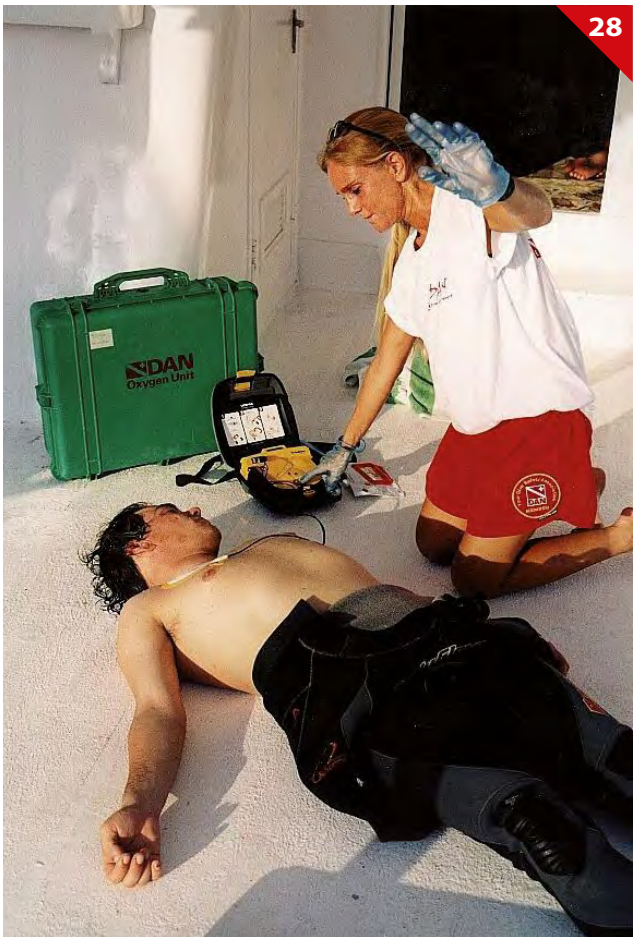


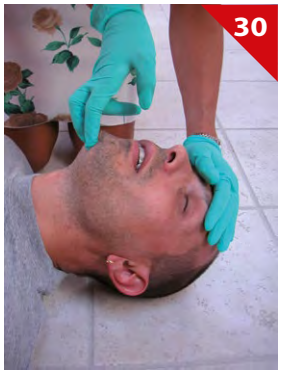

Fig. 28:
The use of an AED is highly recommended and can be of vital importance

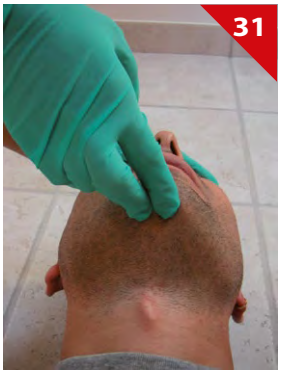
ECG interpretation (analysing of the heart) is done by software internal to the defibrillator that has been tested in thousands of simulated cases in the laboratory and clinically field tested.

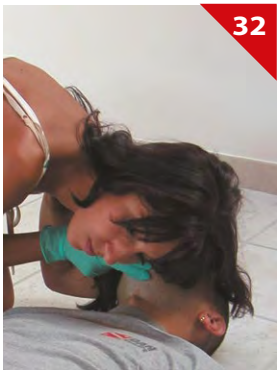
AEDs are designed to advise the operator if a “shockable” rhythm is detected. If a non-shockable rhythm is detected it is designed to give the operator a “ no shock advised” message.

**By taking an BLSD course, you can increase your response time to using an AED by a few minutes and you may improve someone's chance of survival by as much as 30 or 40 percent!**

# BLS Skill: Resuscitation - CPR

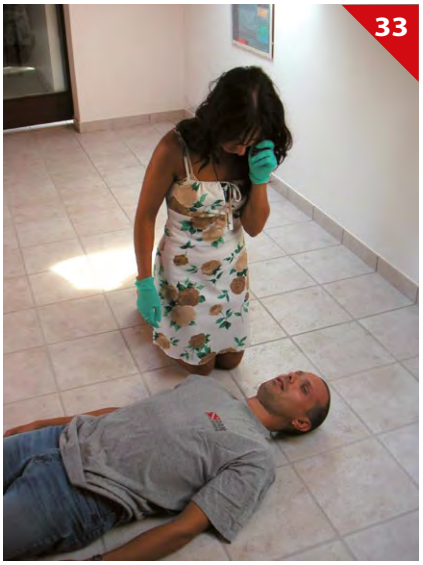

1. **Make sure you, the injured person and any bystanders are safe.**
2. **Check the injured person for a response.**
   - State your name, training and desire to help.
   - Ask permission to help.
   - Gently shake the injured person's shoulders and ask loudly: "are you all right?" (Pic. 29)

   **2a. 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.

   **2b. If he does not respond:**
   - Turn the injured person on 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 (Pic. 30).
   - With your fingertips under the point of the injured person's chin, lift the chin to open the airway (Pic. 31).
3. **Keeping the airway open, look, listen and feel for breathing.**
   - Look for the chest movement.
   - Listen at the injured person's mouth for breath sounds.
   - Feel for air on your cheek.
   - Decide if breathing is normal, not normal or absent.

In the first minutes after cardiac arrest, an injured person may be barely breathing, or taking infrequent, noisy gasps. Do not confuse this with normal breathing.

Look, listen and feel for no more than 10 seconds to determine whether the injured person is breathing normally (Pic. 32). If you have any doubt whether breathing is normal, act as if not normal.






**3a. If he is breathing normally:**

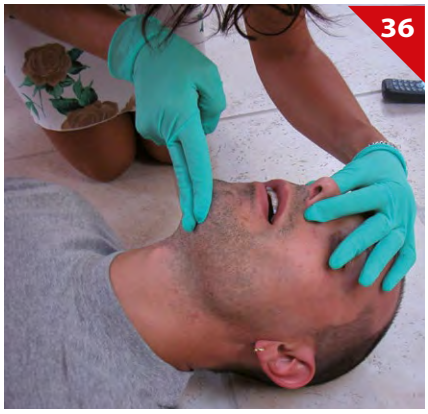
- Turn him into the recovery position.
- Send or go for help / call an ambulance (Pic. 33).
- Continue to assess that breathing remains normal.

**3b. 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 injured person when there is no other option.
- Start chest compressions as follows:
  - Kneel by the side of the injured person.
  - Place one heel of one hand in the centre of the chest (which is the lower half of the injured person'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 injured person's ribs. Keep your arms straight. Do not apply pressure over the upper abdomen or the bottom end of the sternum (Pic. 34).
  - Position yourself vertically above the chest and press down on the sternum at least 5cm (but not exceeding 6cm) (Pic. 35)
  - After each compression, release all the pressure on the chest without loosing contact between your hands and the sternum; repeat a rate of at least 100/minute (but not exceeding 120/ minute)
  - Compression and release should take equal amounts of time.

**4. Combine chest compressions with rescue breaths.**

- After 30 compressions open the airway again using the head tilt and chin lift.
- Use an oronasal resuscitation mask or pinch the soft part of the nose closed, using the index finger and thumb of your hand of the forehead (Pic. 36).
- Allow the mouth to open, but maintain chin lift.
- Take a normal breath and place your lips on the inlet of the oronasal resuscitation mask, or around his mouth, making sure that you have a good seal (Pic. 37).
- Blow steadily in to the mask / mouth while watching the chest to rise, taking about 1 second as in normal breathing; this is an effective rescue breath.
- Maintaining head tilt and chin lift, take your mouth away from the injured person and watch for the chest to fall as air comes out.






- Take another normal breath and blow into the person's mouth (or in the mask), to achieve a total of 2 effective rescue breaths. Do not interrupt chest compressions for more than 10 second to provide ventilations. Then return your hands without delay to the correct position on the sternum and give another 30 compressions
  (Fig. 38).
- Continue CPR in a ratio of 30:2.
- Stop to recheck the injured person only if he starts to wake up: to move, open eyes and to breath normally: Otherwise do not interrupt resuscitation.
- **If your initial rescue breath do not make the chest rise as in normal breathing, then before your next attempt:**
  - Check the injured person's mouth and remove any obstruction
  - Recheck that there is adequate head tilt and chin lift
  - Do not attempt more than 2 breaths each time before returning to chest compressions
- **If there is more than one rescuer present, another rescuer should take over delivering CPR every 2 minutes to prevent fatigue. Ensure that interruption of chest compressions is minimal during the changeover of rescuers.**

**4a. Chest-compression-only CPR may be used as follows:**

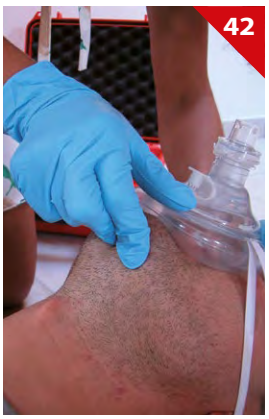
- If you are not trained, or are unwilling to give rescue breaths, give chest compressions only
- If chest compressions are given, these should be continuous, at a rate of at least 100/minute (but not exceeding 120/minute)

5. **Do not interrupt resuscitation until:**
   - Professional help arrives and takes over; or
   - The injured person start to wake up: to move, opens eyes and to breathe normally; or
   - You become exhausted.

**Note**

**For victims of drowning:** give 5 initial rescue breaths before starting chest compressions and perform 1 minute of CPR before getting help.

# Optional Skill: The use of a resuscitation mask




- Remove the mask from the plastic box (Pic. 39).
- Position yourself beside the victim's head to provide rescue breathing and chest compressions.
- Apply the mask to the victim's face, using the bridge of the nose as a guide for correct position.
- You can use the elastic to keep the mask in place (Pic. 40).
- Seal the mask by placing your index finger and thumb of the hand closer to the top of the victim's head along the border of the mask and placing the thumb (also possible to use thumb and index finger) of your other hand along the lower margin of the mask (Pic. 41).
- Place your remaining fingers on the hand closer to the injured diver's feet along the bony margin of the jaw and lift the jaw while performing a head tilt-chin lift (Pic. 42).
- Compress firmly and completely around the outside margin of the mask to provide a tight seal.
- Provide slow effective rescue breaths while observing for chest rise (Pic. 43).

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# *What a course...*

## DAN BLS-D Adult/Paediatric:

# Spread the voice!

?

# Section 5

## REVIEW QUESTIONS

1. **The current (ERC 2015 guidelines) compression / ventilation ratio is:**
   - **a.** 30:2
   - **b.** 15:2
   - **c.** 5:1
   - **d.** 50:2

2. **How can you avoid air entering the stomach and causing gastric distension?**

3. **What must you do when a victim regurgitates?**

4. **A rescuer should ____ the injured person by showing a carrying attitude, inform the _____ about what is happening and that he is taking care of him and keep bystanders _____.**

5. **Chest compressions should be given at a rate of ____ a minute , but not exceeding ____ a minute or ___ compressions in about ____ seconds.**
   - **a.** 100, 120, 30, 15-18
   - **b.** 120, 140, 30, 12-15
   - **c.** 100, 120, 30, 12-15
   - **d.** 100, 140, 15, 15-18

6. **Each ventilation should take about ____ second in duration.**

7. **The use of an AED are _____ and might _____ the chance of survival.**
   - **a.** Forbidden, decrease
   - **b.** Recommended, increase

**Review answers are on pag 79**

# Recovery Position

Placing an unconscious, breathing person in the recovery position (Pic. 44) is important to maintain an open airway and to prevent blood and vomit obstructing the airway (or flowing into the lungs).

The position in which the victim needs to be placed should be stable, near a true lateral position with the head supported and airway open. There should be no pressure on the chest to avoid breathing problems.

Should vomiting occur or when blood is present in the mouth, gravity will make sure it leaves the body and is not inhaled. It will also be easier for the rescuer to see the presence of blood or vomit in the mouth.

There are several small variations of the recovery position. The position described in this book is the position the ERC recommends, but is not the only adequate position possible.

In general however, the following points must be respected:


Pic. 44:
Recovery position

- Persons with back or neck injury should not be placed in the recovery position. Movement might do more damage
- A person with a chest injury should be turned onto the injured side. This is to ensure that any blood within the chest cavity is more likely to affect only one lung rather than both of them
- A person with a lung injury should be turned onto the side of the injured lung to ease breathing [1].

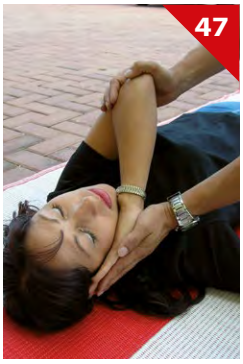
**Note**

- If the recovery position is used, you should take care to monitor the pe-ripheral circulation of the lower arm, and to ensure that the duration for which there is pressure on this arm is kept to a minimum.
- If the injured person has to be kept in the recovery position for more than 30 minutes, he should be turned to the opposite side.

*1 A visibily pregnant woman should be placed on her left side.*

# BLS Skill: Recovery Position








- Remove spectacles.
- Kneel beside the injured person and make sure that both his legs are straight (Pic. 45).
- Place the arm nearest to you at right angles to the body, elbow bent with the hand palm uppermost (Pic. 46).
- Bring the far arm across the chest and hold the back ofthe hand against the injured person's cheek nearest toyou (Pic. 47).
- With your other hand, grasp the far leg just above theknee and pull it up, keeping the foot on the ground (Pic.48).
- Keeping the hand pressed against the cheek, pull thefar leg to roll the injured person towards you onto hisside.
- Adjust the upper leg so that both the hip and knee arebent at right angles (Pic. 49).
- Tilt the head back to make sure the airway remainsopen (Pic. 50).
- Adjust the hand under the cheek, if necessary, to keepthe head tilted (Pic. 51).
- Check breathing regularly.


# Section 6

## REVIEW QUESTIONS

1. **Placing an unconscious, breathing victim in the recovery position is important to maintain an open airway and to prevent blood and vomit obstructing the airway.**
   **a.** True
   **b.** False

2. **Persons with back or neck injury should not be placed in the recovery position.**
   **a.** True
   **b.** False

3. **A person with a chest injury should be turned onto the _____ side.**

4. **A person with a lung injury should be turned onto the side of the good lung to ease breathing.**
   **a.** True
   **b.** False

**Review answers are on pag 79**

# Foreign-Body Airway Obstructions (FBAO)

In an unresponsive person, airway obstruction might be caused because the tongue fell backwards in the mouth due to a decreased muscle tone. The Head Tilt – Chin lift technique will open the airway again in his case.

With responsive persons, the presence of foreign bodies in the airway is the main reason why a person has a blocked airway and is choking.

The most common cause of choking in adults is airway obstruction caused by food. With infants and children choking is mostly caused by food (such as candy), toys or coins.

This obstruction prevents a normal flow of air in the windpipe and might result in a respiratory arrest.

Since choking occurs mostly while eating, the problem can be recognised soon and assistance might be given in an early phase while the victim is still responsive.

Foreign bodies might cause mild or severe airway obstruction. In general the victim may grip his neck and stand up (Pic. 52).

It is important to ask the victim “Are you choking” to differentiate between mild and severe airway obstruction.

In the case of **Mild Airway Obstruction** the victim will be able to answer your question, will be coughing (effective) and is breathing.

With **Severe Airway Obstruction** the victim will be unable to speak, but might nod his head as a response to your question. He will not be able to breathe or will have a wheezy breathing and can make silent attempts to cough (ineffective). He also might loose consciousness soon.

First Aid depends on the Severity of the Airway Obstruction. In the case of a **mild** airway obstruction the rescuer should encourage the choking victim to cough, but should do nothing else.

If the victim shows signs of a severe airway obstruction and is conscious the rescuer should give up to 5 back blows (Pic. 52), (sharp blows between the shoulder blades), followed by up to 5 abdominal thrusts (Heimlich manoeuvre) in case the back blows didn’t relieve the obstruction.

These actions should be repeated until the obstruction is relieved. If the victim at any time becomes unconscious, the rescuer should start CPR.

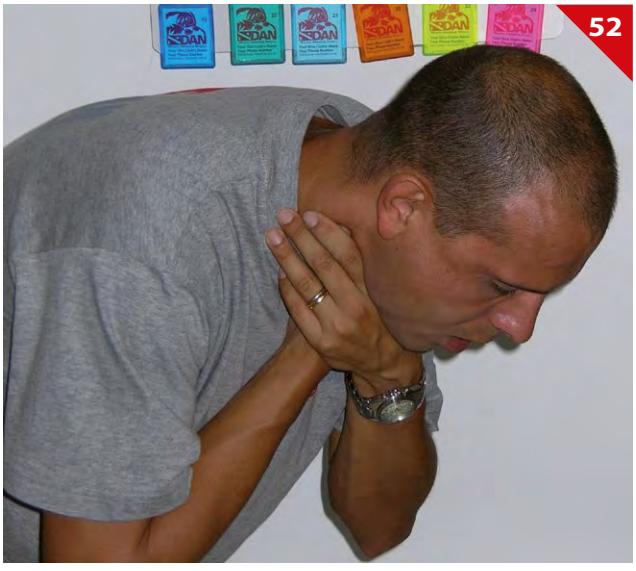



Fig. 52:
Gripping the neck and standing up is a common sign in airway obstructions.

# 1. Removing foreign matter from the mouth

## Finger Sweep

When solid materials in the airway can be seen, the rescuer can also use his fingers to remove the foreign matter.

The victim however should in this case be unresponsive and preferably placed at his side.

While one hand is used to keep the jaw open, the rescuer can use the index finger from the other hand to go along the cheek to the back of the mouth. The index finger should be hooked behind the foreign material and the material can be pulled out.

## Removing liquids in the Airway

Blood, and vomit (regurgitation of gastric contents) can also cause an obstruction of the airway.
In most cases, and thanks to gravity, turning the victim at his side, while keeping the airway open will remove these fluids from the mouth (you can use a half “Log Roll” as described in the final section of this book).

It is also possible to use a suction device to remove liquid from the upper airway.
This technique is however not discussed in this book.

## Victims of Drowning: aspiration of water

The aspiration of water can be suspected in victims of drowning. However, in most cases, drowning victims aspirate only a modest amount of water and this is absorbed quickly into the central circulation.

There is therefore no need to clear the airway of aspirated water before starting CPR.

Regurgitation is however common following resuscitation from water and can make it difficult to maintain a clean and open airway.

Whenever regurgitation occurs, the rescuer should turn the victim on his side and clean the airway by removing the regurgitated materials.

A finger sweep or suction technique can be used when doing this.


Fig. 53:
The use of back blows to relieve obstruction

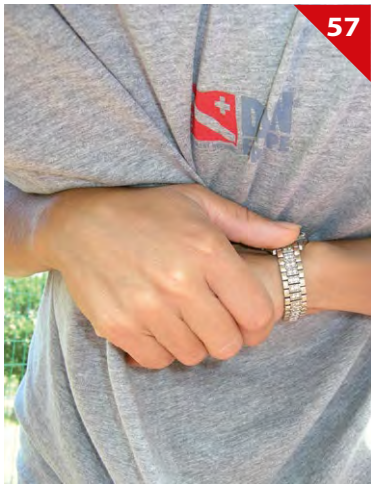
# BLS Skill: Foreign-Body Airway Obstruction



In the case of a **mild** airway obstruction you should encourage the choking victim to cough, but should do nothing else.

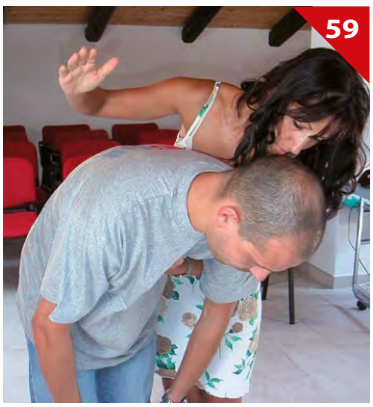
If the victim shows signs of a **severe** airway obstruction and is conscious you should:

- Give up to 5 back blows:
  - Stand to the side and slightly behind the victim
  - Support chest with one hand and lean the victim well forward so that when the obstructing object is dislodged, it comes out of the mouth rather than going further down the airway (Pic. 54)
  - Give up to 5 sharp blows between his shoulder blades with the heel of your other hand (Pic. 55)
  - Check to see if each back blow has relieved the obstruction. The aim should be to relieve the obstruction with each slap rather than necessarily to give all five



- If back slapping fails, give up to 5 abdominal thrusts:
  - Stand behind diver and put both arms round the upper part of his abdomen
  - Lean the victim forwards so that when the obstructing object is dislodged, it comes out of the mouth
  - Clench your fist and place it between the navel and bottom tip of the sternum (Pic. 56)
  - Grasp it with your other hand and pull sharply inwards and upwards; the obstructing object should be dislodged (Pic. 57-58)
  - Repeat up to 5 times
- If the obstruction is still not relieved, continue alternating five back blows with five abdominal thrusts (Fig. 59).




If the victim at any time becomes unconscious:

- Support the victim carefully to the ground
- Activate EMS
- Start CPR (chest compressions followed by rescue breaths)

?

# Section 7

## REVIEW QUESTIONS

1. **The most common cause of chocking in adults is airway obstruction caused by _____. With infants and children chocking can also be caused by ____.**

2. **As a common sign during choking, the victim may grip his neck.**
   **a.** True
   **b.** False

3. **To differentiate between mild and severe airway obstruction you must:**
   **a.** Look in the mouth of the victim
   **b.** Check responsiveness
   **c.** Ask “are you choking?”
   **d.** Ask a doctor

4. **With Severe Airway Obstruction the victim will be unable to _____, but might nod with his head as a response to your question. He will not be able to _____ or will have a wheezy breathing and can make silence attempts to _____. He also might loose _____ soon.**

5. **In the case of a mild airway obstruction the rescuer should encourage the choking victim to cough, but should do nothing else.**
   **a.** True
   **b.** False

6. **If the victim shows signs of a severe airway obstruction and is conscious the rescuer should give up to _____, followed by up to _____ in case the obstruction was not relieved.**

7. **If the victim at any time becomes unconscious, the rescuer should _____.**

**Review answers are on pag 79**

# Control of external bleeding

The primary function of the blood is to supply nutrients and oxygen to the body tissues and to remove the waste products (like carbon dioxide).

Blood is composed for 55% of plasma (liquid) and for 45% of cells or solid particles (44% red blood cells, and 1% white blood cells and platelets).

The **blood plasma**, which is a clear yellowish fluid, carries blood cells and platelets. Without this plasma blood would not be able to flow.

**Red Blood** cells contain Haemoglobin, which gives the blood his red colour. This haemoglobin is the body's primary transporter of oxygen and is saturated with about 97% of oxygen when the blood is leaving the lungs. About 98,5% of oxygen in the blood is chemically combined with haemoglobin. The rest is dissolved in the plasma.

These red blood cells also transport the carbon dioxide back to the lungs, where it will leave our body.

**White blood** cells are colourless and are protecting the body against viruses and bacteria (some white blood cells can form antibodies, which can kill microbes). They also help to remove the cells which died in the body.

**Platelets** are the smallest cells and have an important role in the bodies natural blood clotting process. During bleeding, these platelets will create an artificial dam to reduce or stop the blood loss. An adult human has about 5,5 litres of blood, depending on his body weight.

When loosing approximately 1 litre of blood an adult can go into hypovolemic shock because of the decreased or low blood volume (also called hypovolemia).

This is a life threatening situation that will be discussed in the next section of this book.

Severe bleeding (Haemorrhage) must be stopped to avoid hypovolemia. Because the total amount of blood in a child is much less than in an adult, even minor bleedings in children could lead to hypovolemia.

When bleeding occurs, the blood vessels will constrict to slow blood loss and the platelets will start to create an artificial dam in order to stop the bleeding and to avoid bacteria entering the bloodstream from outside.

For minor bleeding this process works extremely well, but for severe bleeding help is needed.

Bleeding can be internal or external. In this section we will discuss external bleeding.

We have 3 categories of bleeding:

**Capillary bleeding**: an easy to control bleeding that occurs when capillaries are damaged. Capillaries are the smallest blood vessels in the body. Capillary bleeding is slow and tends to ooze rather than flow. In most cases this kind of bleeding will stop without any intervention from outside. Note however that even when there is minor bleedings, there is a risk of infection and the wound should be disinfected and covered with a sterile dressing.

**Venous bleeding**: This bleeding can still be controlled quite easily, but is already more severe. It occurs when veins are damaged. Veins are blood vessels returning the blood to the heart. Venous bleeding is dark red in colour and comes out of the wound in a steady flow. This bleeding mostly stops when applying direct pressure and bandaging.

**Arterial bleeding**: Arterial bleedings are always severe bleedings that need immediate attention. Arterial bleeding occurs when an artery is damaged. Arteries carry the oxygenated blood from he heart throughout the body. Because it comes from the heart the blood spurts from the wound at a relatively high pressure (pumping of the heart) and has a bright red colour. This bleeding is hard to control.

*The rescuer should not loose any time to differentiate between venous and arterial bleeding. Both kinds of (severe) external bleeding require the same first aid.*

## 1. Using hemostatic dressings / tourniquet

If trained:

For managing serious external bleeding it is also possible to use hemostatic agents: these products have been designed to aid the natural clotting function of the blood, and the resulting reduction of serious external bleeding that can be life-threating, especially for wounds where direct pressure alone is not effective, and a tourniquet cannot be used.

If the above-mentioned procedures do not result in controlling the bleeding, and the wound involves a limb, it is possible to proceed by using a tourniquet.

# BLS Skill: (Severe) External bleeding





- Assess the scene and the ABC's (use gloves).
- Call the ambulance if required.
- Place a pad (sterile gauze) over the wound and apply direct pressure (with your hand) to the wound (Pic. 60).
- Secure the pad with a sterile dressing. The pad should not be moved and the dressing big enough to cover the pad and wound site completely (Pic. 61 - 62).
- The dressing should be tight, but should also not prevent circulation. You can check circulation by squeezing the fingertips and looking for the pink colour under the nail to return quickly.
- Reassure the injured person and keep him still.
- When bleeding has stopped, immobilise the wound or extremity. A triangular bandage can be used to limit movement (Pic. 63).
- Monitor vital signs, look for signs of shock and act accordingly.

**Note**

If the bleeding continues and seeps through the pad you are holding on the wound, don't remove it as it would remove blood clots which help to control bleeding. Instead, add more absorbent material.

# Section 8

## REVIEW QUESTIONS

1. **The primary function of the blood is to supply oxygen to the body tissues and to remove the carbon dioxide.**
   **a.** True
   **b.** False

2. **Red blood cells contain Haemoglobin ,which carry the _____, white cells are protecting the body against _____ and the platelets take care of the _____ proces.**

3. **During venous bleeding, blood has a _____ red colour and the blood _____ out of the wound. In arterial bleeding, the colour is _____ red and the blood _____ out of the wound.**

4. **During severe bleeding you should apply direct pressure and elevate the extremity.**
   **a.** True
   **b.** False

5. **The rescuer should use a tourniquet when bleeding does not stop.**
   **a.** True
   **b.** False

**Review answers are on pag 79**

# Shock management

## 1. What is shock?

Shock is a life threatening condition caused by an inadequate oxygen supply to the major body organs.

This reduced oxygen supply is mostly caused by:

- Severe bleeding: internal or external bleeding, or
- An excessive fluid loss: like in cases of severe burn or severe vomiting and/or diarrhoea (dehydration).

This type of shock is also called hypovolemic (low volume) shock: Other types of shock include:

- Cardiogenic Shock: Shock due to inadequate pumping of the heart. This may occur after a heart attack, heart failure, or certain other heart problems (resulting in a low blood pressure or bad circulation)
- Septic Shock: Shock due to circulatory insufficiency caused by infection (such as blood poisoning)
- Anaphylactic Shock: Caused by a severe allergic reaction. This can include a reaction to a bee sting, penicillin or shellfish (crustaceans)
- Insulin shock: Caused by a very low blood sugar level such as occurs with diabetes
- Neurogenic Shock: Caused by
- A severe damage to the central nervous system, after for example a head of spinal cord injury, resulting in vasodilatation (dilating of blood vessels) and a decreased blood pressure

Due to a low blood pressure or a low volume or circulating fluids, caused by for example a bad heart function or severe blood loss, there will be an inadequate blood (and oxygen) supply to body cells.

As a reaction, the body will try to supply the brain (which is very sensitive to a reduced oxygen supply) with enough oxygen by reducing the oxygen supply to for example muscle tissues, limbs and skin (less sensitive to a reduced oxygen supply).

This will result however in other (vital) organs or cells receiving also less oxygen, even if they are sensitive to the lack of oxygen themselves (like kidneys, which are vulnerable to damage from low blood pressure).

Because of these changes in the body, the following signs and symptoms can be present:

- Anxiety, restlessness, confusion: caused by the reduced oxygen level in the brain
- Rapid, shallow breathing: breathing increases as reaction from the brain to the decreased oxygen supply
- Rapid, weak pulse: because the heart increases the circulation of oxygen (blood) to compensate the decrease in oxygen supply
- Pale and cold skin: caused because of a reduced oxygen supply to muscles and skin

- Clammy skin: because the changes in the body make the victim sweat
- Thirst: a sign that the amount of circulating fluids isn't enough
- Nausea and vomiting: because the intestines and stomach receive less blood (less oxygen), they are not working properly anymore and this causes nausea and vomiting
- Enlarged pupils
- Weakness and (in case of severe shock) unconsciousness


Fig. 64:
No fluids should be given in case of shock

**Note**

Although a person in shock might be extremely thirsty, no fluids should be orally given during first aid (Pic. 64). he reason is that the victim is assumed not entirely conscious and giving him to drink might lead to aspiration and choking.

In profound shock, water absorption may be impaired, and that may be another compounding factor, although water is mostly not considered dangerous, but probably simply useless.

Giving something to drink might also increase the likelihood of vomiting, making dehydration (or fluid loss) even worse.

Administration of IV fluids is however recommended, but can only be given by professional health care providers.

## 2. Why does extreme fluid loss might lead to shock?

As seen before, oxygen is transported by the blood. It therefore is logical that a severe blood loss can lead to shock.

When vomiting or diarrhoea occurs a persons looses a lot of fluid in his body. This fluid comes from body cells and tissues, but also out of the blood vessels. This reduces the blood volume and might lead to shock in severe cases of vomiting or diarrhoea.

With severe burns there is a fluid loss because of the burned skin and the amount of fluid in the tissues and under the skin increases. This results in oedema (swelling of tissue). This extra fluid in the tissues comes out of the blood vessels, also leading to a lower blood volume and in severe cases shock.

In the case of dislocations, contusions or fractures we see the same and there is an increased risk of internal bleeding, making the fluid loss even worse.

## 3. What to do?

The rescuer should deal with the underlying cause of the shock. In general for the first aid provider this means to stop external bleeding (see section 8).

In case of an Anaphylactic or Cardiogenic it might also be possible that the victim carries medication.

Rescuers should also:

- Make sure the scene is safe
- Assess the vital signs
- Activate EMS
- Maintain open airway
- Keep the victim calm
- If there is not trauma evidence, put the victim in supine position and lift the lower limbs (less than 7 minutes) to allow a further temporary vital signs improvement (Pic. 65)
- Maintain a normal body temperature. The victim will not be able to regulate his body temperature himself. (Isothermal) Blankets or other materials (like a sweater or jacket) can be used to protect the victim from the cold. The rescuer must also avoid that the victim becomes overheated. If outside, the injured person can be placed in the shadow. (See notes concerning the use of an isothermal blanket)


Fig. 65:
Elevate legs slightly in case of shock

### Note

Do not force a person to lie down or put his feet up, if he is not comfortable in that position. Don't elevate his legs if it would make another injury worse.

**Persons with shock will need to be hospitalised for further treatment. However, even with treatment, shock after a massive heart attack or due to blood poisoning is often fatal.**


Fig. 66:
The use of an isothermal blanket

### Note - Isothermal blanket (Pic. 66)

The reflecting material of some isothermal blankets can be used as protection from the cold as well as protection from the heat. These rescue blankets have a gold and a silver coloured side.

When the victim is wrapped in the blanket and the golden side is up, then he will be protected against hypothermia (undercooling). When the silver side is up, the blanket protects against heat. These blankets do not take much space and have a low cost.

# BLS Skill: Shock management



- Make sure the scene is safe.
- Assess the vital signs.
- Activate EMS.
- Control (severe) external bleeding if present.
- Maintain open airway.
- Comfort and reassure injured person.
- If there is not trauma evidence, put the victim in supine position and lift the lower limbs (less than 7 minutes) to allow a further temporary vital signs improvement. (Pic. 67-68).
- Protect the victim from cold or heat. Maintain normal body temperature.
- Monitor the level of responsiveness.
- Monitor and ensure breathing.

## Remarks

- Do not give food or drinks to a person in shock.
- Do not force a person (specially with a heart or breathing problem) to lie down. Place him in the most comfortable (sitting) position.
- Don’t elevate his legs if it would make another injury worse.

# Section 9

## REVIEW QUESTIONS

1. **What is Shock?**

2. **Shock is mostly caused by _____ bleeding or excessive _____ _____.**

3. **List 3 types of shock.**

4. **List the signs or symptoms of shock.**

5. **During first aid you should control _____, position the victim on the _____ with the legs _____, provide _____ and maintain a normal _____ _____.**

6. **Fluids, like water, should be given orally to a person in shock.**
   **a.** True
   **b.** False

7. **Persons with shock will need to be hospitalised for further treatment.**
   **a.** True
   **b.** False

**Review answers are on pag 79**

# Automated External Defibrillation - Sudden Cardiac Arrest

## 1. Sudden Cardiac Arrest - Is This Serious?

Sudden Cardiac Arrest (SCA) kills. In Europe more than 700.000 people die each year from SCA, making it a leading cause of death and the leading cause of death for people over 35.

The causes of sudden cardiac arrest include:

- Heart Disease
- Electric Shock

The most frequent cause of Sudden Cardiac Arrest is a cardiac disease, in absence of trauma, asphyxia or electric shock.

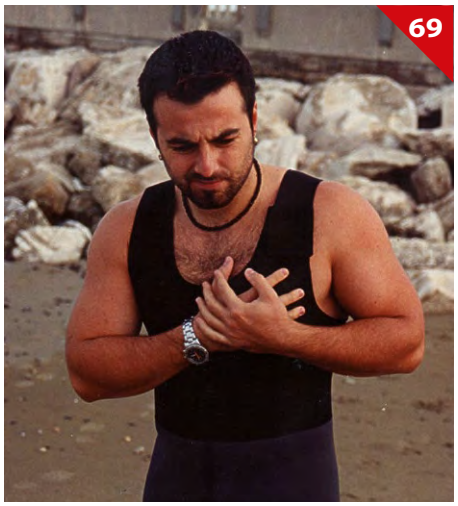
SCA doesn't necessarily happen in a physically stressful environment.

It happens while diving, in airports, shopping malls, on the beach, or on a boat - even at home. It can also happen with little or no warning. However, there are several warning signs you should learn to recognise.

## 2. Warning Signs of Sudden Cardiac Arrest

- Heavy pressure or squeezing pain or discomfort in the centre of the chest behind the breastbone
- Shoulder, arm, neck or jaw pain and discomfort
- Shortness of breath
- Sweating
- Nausea and vomiting
- Denial

The term “massive heart attack” is often used to describe a sudden cardiac arrest. “Heart attack” refers to heart muscle death caused by loss of blood supply — not necessarily resulting in death. All types of heart disease can lead to sudden cardiac arrest, and half of all deaths from heart disease are sudden and unexpected.




Pic. 69:
Pain in the centre of the chest is a common symptom of a heart attack

# 3. What Happens During Sudden Cardiac Arrest?

## The Heart

The heart is a hollow muscular organ situated in the chest between the lungs in a space called the mediastinum. The heart, like the lungs, is surrounded by a thin connective tissue sac, the pericardium that allows the heart to beat independently without friction. The heart is situated obliquely, one-third to the right and two-thirds to the left of the sternum.

The heart is a strong muscular pump that, in the average adult, beats about 60 -100 times per minute. Every minute, approximately 6 litres of blood is pumped throughout the body. When exercising, this output doubles or triples depending upon the amount of exertion.

The heart consists of two separate pumps, one on the left side and one on the right side. Each pump has two chambers. The upper chamber, or atrium, receives blood from the body or the lungs, and the lower chamber, the ventricle, is filled with blood from the atrium. The pumps work by muscular contractions squeezing the blood out of the chambers. The left ventricle pumps oxygenated blood throughout the body in what is known as the systemic circuit, and the right ventricle pumps deoxygenated blood (blood returning to the heart) to the lungs in what is known as the pulmonary circuit.

The heart muscle is supplied with blood by a network of arteries, the “coronary arteries”. These branch of from the base of the main artery that leaves the heart (the aorta). They also direct deoxygenated blood back towards the right side of the heart.

## The electrical system of the heart

The heart has a channel of specialised tissue called conductive fibers that distribute electricity throughout the heart. This is known as the “electrical” system of the heart.

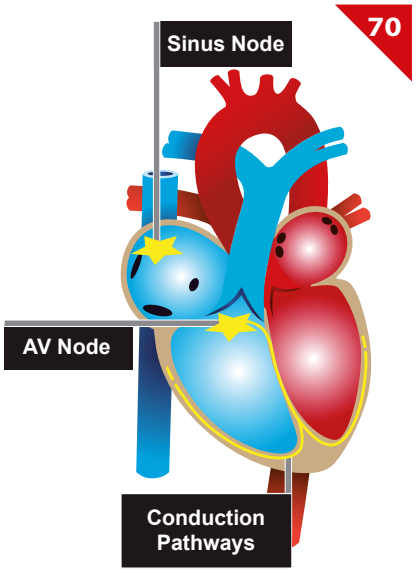
This network delivers electrical impulses directly to the cardiac muscle tissue, which is stimulated to contract and pump blood. The pumping of the heart is the “mechanical” activity which results in a pulse. Without an electrical signal the heart will not pump.

## Pacemakers

The conductive fibers have the unique ability to generate their own electrical impulses. The heart’s primary impulse generator is the sinoatrial (SA) node located in the right atrium. It is called the primary pacemaker because it is the site that normally generates impulses.

The conductive fiber network carries an impulse generated in the SA node through the cardiac muscle tissues of the atria. This causes the atria to contract. Next, the impulse travels through the network to the ventricles into the connecting blood vessels.

Should the SA node fails to generate an impulse, another site in the network will usually take over and generate impulses. The atrioventricular (AV) node is an example of one site along the network that can also be used as a pacemaker.




Pic. 70:
The sinoatrial node is the impulse generating (pacemaker) tissue located in the right atrium of the heart

## Dysrhytmias

The ECG of a healthy heart shows an organised, uniform rhythm called Normal Sinus Rhythm (NSR). The persons with NSR will have a pulse. This pulse is produced by the heart's pumping.

Dysrhytmias are abnormal heart rhythms that can prevent the heart from pumping properly. There are numerous causes of dysrhythmias including:

- Narrowing an hardening of the arteries of the heart (coronary heart disease)
- Chemical imbalances
- Trauma to the heart muscle Low Blood oxygen levels (drowning, suffocation)
- Central Nervous System damage
- Drugs and Medications
- Electrocutions
- Hypothermia (low body temperature)

Coronary heart disease is a major cause of cardiac arrest. A heart attack is caused by heart disease too. However, when someone has a heart attack, the heart does not usually stop beating.

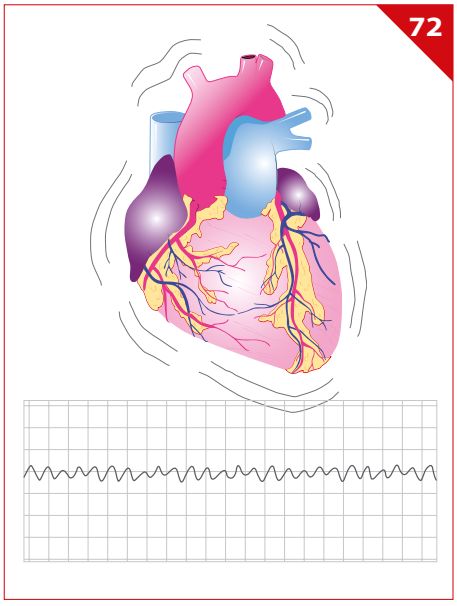
A heart attack occurs when a blood clot suddenly blocks a coronary artery and the heart is deprived of oxygen.

The outcome depends on the extend to which the heart muscle is affected. Many heart attack victims recover completely. In a number of victims however, the normal electrical signal will be disturbed and turned into a chaotic rhythm called "ventricular fibrillation". The heart will contract in a completely disorganised way. The result is cardiac arrest.

## Ventricular Fibrillation

Sudden Cardiac Arrest (SCA) means that the heart has stopped beating unexpectedly. The most common dysrhythmia associated with SCA is ventricular Fibrillation (VF). VF is an unorganised rhythm in which many sites in the heart attempt to function as the pacemaker. The chaotic electrical activity results in uncoordinated and ineffective cardiac muscle contractions which prevent the circulation of blood. There is no pulse or blood pressure. A heart in VF looks like a quivering bowl of jelly.


Pic. 71:
ECG of a healthy heart - NSR




Pic. 72:
ECG of a heart in VF

# 4. Defibrillation — The Treatment for Ventricular Fibrillation (VF)

Regardless of the cause, when the heart stops beating, if you can't reset the heart's rhythm, the person will die. The only way to reset a heart in ventricular fibrillation (VF) is with defibrillation.

The goal of defibrillation is to reorganise the chaotic electrical activity of VF and return the heart to a normal rhythm. After a shock the SA node or another area of the heart can regain control as the primary pacemaker.

For years, you've learned about cardiopulmonary resuscitation (CPR). While CPR delays the inevitable by helping to oxygenate blood and circulate it throughout the body, CPR cannot reset the heart rhythm and make it begin beating again.

Only defibrillation can do that.

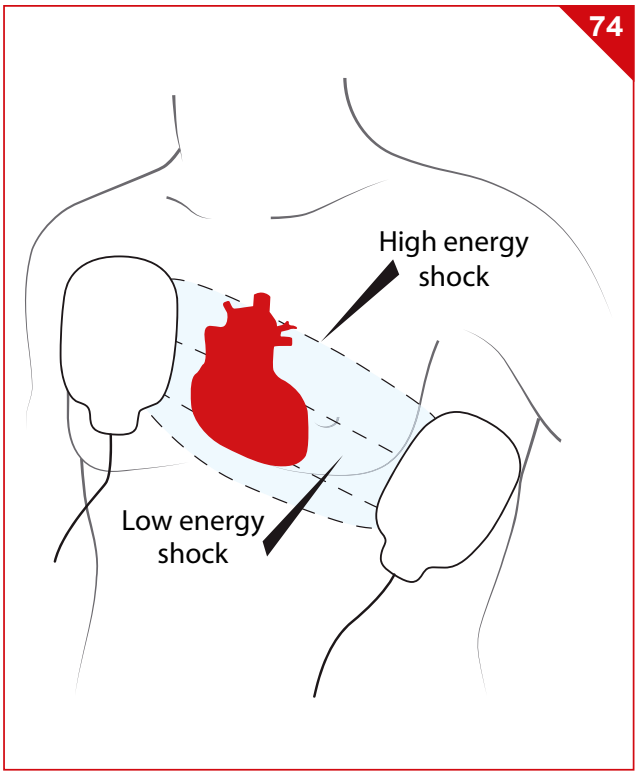
While few good statistics for out of hospital CPR exist, the American Heart Association and the International Liaison Committee on Resuscitation (ILCOR) maintains that the early use of CPR and rapid defibrillation, combined with early advanced care, can result in longterm survival rates for witnessed ventricular fibrillation as high as 40 percent.

Defibrillation sends an electric shock through the heart, via the disposable electrodes or pads and essentially hits a “reset” button. The electrodes are positioned so that the charge will pass through the heart. The electrical shock doesn't tell the heart how to beat or contract. What it does is scramble all of the misfiring signals and stop all of the electrical activity. The heart stops for a moment, and the body's natural pacemaker begins firing again, restoring a normal rhythm.

When defibrillation is provided within the first few minutes after VF begins, the person has a very high survival rate. Every minute defibrillation is delayed, the chance of survival drops by 7 to 10 percent.

While this course is diveoriented, AEDs are effective for treating SCA in any environment. The skills you learn in this course are transferable to any situation.


Pic. 73:
Defibrillation:
from VF to NSR




Pic. 74:
View of defibrillator
electrode position and
placement

## Other Dysrhythmias

If you arrive early on the scene of a cardiac arrest you will be more likely to find VF or pulseless ventricular tachycardia (VT). Pulseless VT is a rhythm that often precedes VF. It occurs when a site in the ventricular muscle fires rapidly and takes over as the dominant pacemaker. As the heart rate increases, there is less time for the ventricles to fill with blood.

This reduces the amount the heart can pump and blood pressure falls. If the blood pressure drops severely, consciousness and pulse will be lost. Both VF and VT are treated with electrical shocks.

There are some dysrhythmias of cardiac arrest which are not treated with electrical shocks. Asystole (also known as “flat line” or no electrical activity in the heart) and pulseless electrical activity (“PEA” - electrical activity but no pumping of the heart) are examples of dysrhythmias that do not respond to external shocks.

## Electrocardiograms

The electrocardiogram (ECG) is a measurement of the electrical activity in the heart. The impulses from the heart pass through body tissues and reach the skin. The electrical energy can be detected by disposable electrodes placed on the skin.The heart’s electrical signals detected on the skin are a very low voltage so they must be amplified by the AED.

Artefacts may be induced by: victim movement, muscle tremors, use of dried out or poor quality electrodes, loose electrodes and interference from electronic devices and lightning.

**Note**

AEDs also amplify any other electrical signals (called artefact) detected by the disposable electrodes. It is important to minimise all movement and extraneous sources of electrical signals because they could be confused with or mask the heart’s electrical activity.

# 5. Who Can Provide Defibrillation?

Until recently, it required a tremendous amount of training to operate a defibrillator. You had to understand the heart rhythms (ECG interpretation) on the monitor before you could administer a shock. If the person wasn't already in ventricular fibrillation when you applied the shock, you could put him there. The necessary training required made defibrillaors the domain of medical professionals. Doctors and nurses could use them in the hospital, or paramedics could use them at the scene of an emergency.

Unfortunately, survival rates drop by about 7 to 10 percent every minute a person is in ventricular fibrillation. Long response times from emergency medical services professionals decrease the effectiveness of defibrillators in the field.

Defibrillation technology has evolved to give us Automated External Defibrillators (AEDs) which simplify defibrillation operation and greatly reduce the training needs to use a defibrillator.

ECG interpretation (analysing of the heart) is done by software internal to the defibrillator that has been tested in thousands of simulated cases in the laboratory and clinically field tested.

AEDs are designed to advise the operator if a “shockable” rhythm is detected VF or Pulseless VT). If a non-shockable rhythm is detected it is designed to give the op-erator a “ no shock advised” message.

You don't need a lot of special training to operate an AED. They are simple to operate and, on some occasions, people have saved the lives of friends, coworkers and complete strangers using AEDs they'd never used before, strictly by listening to the unit and following its directions. However, training is obligatory and often required to purchase the device.

To be comfortable using a piece of equipment, and to purchase an AED, most people need training. Training allows you to be faster and more confident about your actions. If, by taking this course, you can increase your response time to using an AED by a few minutes, you may improve someone's chance of survival by as much as 30 or 40 percent!


Fig. 75:
Defibrillation is a common treatment for life-threatening ventricular fibrillation

# 6. What About CPR?

As you read earlier, CPR is still important in rescue. CPR and AEDs are part of the same chain of survival that you provide in any accident. They rely on each other; neither one is as successful without the other.

There are four links in the Chain of Survival. All four of them have to be present to provide the best chance of survival. They are:

## Early Access to the EMS System

The first link is still important. Even if you have an AED and can administer it immediately, a person whose heart has stopped is still going to need professional medical care quickly. That's why Early Access to EMS is so critical.

## Early CPR

The second link, Early CPR, keeps oxygenated blood flowing to the body until a defibrillator is available. This keeps the body tissues from dying. Tissues like those in the brain and nervous system begin dying after four or five minutes without oxygen.

## Early Defibrillation

The third link, Early Defibrillation, resets the heart and allows it to begin beating normally.

In most cases of cardiac arrest the heart muscle quivers due to “ventricular fibrillation”. VF usually only lasts for few minutes before the electrical activity stops (a systole). Therefore the sooner we can provide defibrillation, the higher the chance for survival.

## Early Advanced Life Support

The fourth link, Early Advanced Life Support, brings medications and advanced procedures to the person who has suffered a sudden cardiac arrest improving the odds of survival that much more.

# 7. You should continue to provide CPR:

- Until AED arrives
- Until AED is attached and ready to use (if there is more than one rescuer)
- After 1 shock with no response (*)
- After a no-shock advisory, when victim is not breathing normally (*)
- If device is unavailable

(*) Provide CPR for two minutes, then AED will analyse again.

# 8. Providing Emergency Care

Adding a defibrillator to basic life support procedures really doesn't alter your emergency response greatly. You will still follow the ABCs and simply add a “D” for defibrillation.


Pic. 76:
After the shock the AED will prompt you to start CPR. Do not wait—start CPR immediately and alternate 30 chest compressions with 2 rescue breaths


Pic. 77:
AED is designed to be simple to use for the layman

# Optional Skill: Providing Care with an AED (BLSD)

**Make sure you, the victim and any bystanders are safe. Follow the Adult BLS sequence:**

- Unresponsive and not breathing normally: Send someone for help and to find an bring an AED if available
- If you are on your own, use your mobile phone to alert EMS – leave the victim only when there is no other option

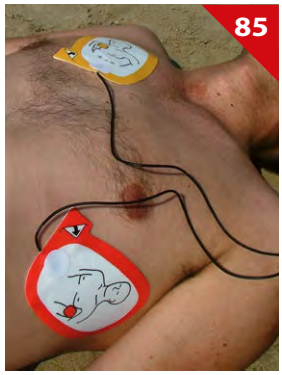
**Start CPR according to the Adult BLS sequence. If you are on your own and the AED is in your immediate vicinity, start with applying the AED (Pic. 78).**


**As soon as AED arrives:**

- Switch on the AED and attach the electrode pads on the victim's bare chest
  — It may be necessary to cut away clothing or wetsuits
  — Chest must be dry ,wipe it off if necessary (Pic. 79 - 80)
- If more than one rescuer is present, CPR should be continued while electrodes are being attached to the chest
- Continue as directed by the voice/visual prompts





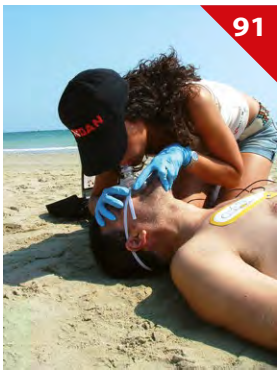

- Remove the pads from the bag (Pic. 81)
- Place the AED pads on the naked chest of the victim (Pic. 82)
- Apply the pads firmly to the chest. Right and left refer to the patient's right and left (Pic. 83-84)
- Place the right pad on the upper right chest, just below the collarbone and to the right of the breastbone (Pic. 85)
- Place the left pad on lower left ribs just below the breast

**Note:** Pad position does not have to be exact.

- Follow the verbal and text prompts the AED unit provides
- Make sure the electrodes are plugged into the AED (Pic. 86)
- AED will analyse the rhythm as soon electrodes are attached to AED/chest:
  — In some older AED models an analyse button needs to be pushed
- Ensure that nobody is touching the victim while the AED is analysing (Pic. 87)








**If shock is indicated:**

- Look to see that no one is touching the person (Pic. 88), by scanning the person head to toe and state: “I'm clear, you're clear, all clear” or simply “clear.”
- Deliver the shock, by pressing the shock button (Pic. 89), if indicated and safe
  - Full automatic AED’s will automatically deliver the shock
- Immediately restart CPR 30:2 (Pic. 90 - 91)
- Continue as directed by the voice/visual prompts

**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

Continue to follow AED prompts until:

- Qualified help takes over
- The victim starts to wake up: moves, open eyes and breathes normally
- You become exhausted

## Notes

- After having delivered a single shock, with no breathing or cardiac rhythm, resume CPR (30 compressions: 2 rescue breaths) for 2 minutes before delivering a second shock (while the AED analyses).
  - If the cardiac rhythm has been restored, thoracic compressions will not enhance the chance of a ventricular fibrillation recurrence.
- The training materials that accompany this course focus on one model of AED. However, this isn't the only AED available. While most of the features on this AED apply to all AEDs, there may be specific operations that vary by brand and model. Operators should be familiar with the AED they will use.
- During the skill session of this course, you will perform different AED scenarios.

# Turn over to EMS

While you are waiting for emergency medical personnel to arrive, the rescuer should:

- Continue to monitor the ABCs
- Leave AED in place

**When EMS personnel arrive (Pic. 92):**

- They may ask you to continue to provide care while they set up
- They may use your AED pads or remove them and use their own

Provide a brief report so they can treat the person accordingly, indicating:

- Nature of the dive accident or incident
- Initial condition
- Care delivered
- Current condition
- Estimated time diver was not breathing and without circulation

# AED Equipment Maintenance

*Follow the manufacturer's recommendations for a periodic equipment check.*

**Check Battery**

- Must have enough power for one complete rescue
  - Run Self test.
  - Check expiration date on supplies: If expired, replace it (Pic. 93).

**Stock up after use**

- Defibrillator Pads
- First Aid supplies including gloves
- Towel or cloth to dry the chest

**Clean Oronasal Resuscitation Mask**

**Reassemble unit and store ready for use**

# Safety considerations

- Attach the AED unit only to victims in sudden cardiac arrest (Pic. 94).
- Do not touch the patient during analysis or shock delivery.
- Verbally and visually clear the patient. State “I’m clear. You’re clear. All clear.”
- Wet surfaces can create an arc between the pads or to the rescuers. Remove patient from standing water and dry chest (also see “other considerations”)
- Place patient on a back board if possible. AEDs may be used on metal surfaces.
- Do not place pads over medication patches. Remove patch and wipe chest before applying pads. These patches could cause sparking or burns during defibrillation.
- Remove any other plasters or other material attached to he victim’s chest to ensure good electrode contact.
- When delivering high concentrations of oxygen, sparking from poorly applied electrodes can cause a fire or significant burns. The risk of fire or burns during defibrillation can be minimised by removing the oxygen mask from the victim’s face and placing it at least 1 meter away from his chest.
- Victims with a hairy chest may have air trapping beneath the electrode and poor electrode-to-skin electrical contact. This can have sparks from electrode to skin and electrode to electrode as a result and is more likely to cause burns to the victim’s chest. Rapid shaving on the area where he electrodes will be applied may be necessary, but do not delay defibrillation if a shaver is not immediately available. It is recommended to keep a shaver with the AED.

# Other Considerations

## Wet environments

- Wet chest: Some victims may have a wet chest (sweating, after a dive or after rescue from water). You should dry the chest before attaching the electrodes to the chest. A small towel or a piece of cloth can be used and it is recommended to keep it with the AED when operating in wet environments (like during diving).
- Wet surfaces: A rescuer or bystander would not be exposed to any hazardous voltages if a patient was defibrillated on a wet surface as long as the appropriate safety precautions are taken. Specifically, no one touches the patient during the energy discharge when the shock button is pressed. As an extra safety precaution the attached AED cable should be extended away from the patient as far as possible before the defibrillation button on the AED is pressed.

## Pacemakers

- Do not place pads over pacemakers.
- See manufacturer recommendations for use with pacemaker.
- Place them at least one inch (two centimetres) away.

## Internal Automated Cardiac Defibrillators (IACDs)

- If an implanted device is delivering shocks - watch for signs of chest muscles quivering — allow 30 to 60 seconds for implant to complete treatment cycle.
- Do not place pads over IACD.
- Place pads at least one inch (two centimetres) away.

## Hypothermic Patients

When a patient is hypothermic with a core body temperature below 30°C, limit defibrillation to a total of 3 attempts, until the core body temperature rises above 30°C.

If ventricular fibrillation persists:

- Continue Basic Life Support.
- Continue attempting to passively rewarm the patient until transfer to EMS.

## AEDs and children

Standard AED’s are suitable for use in children older than 8 years. For children between 1 and 8 years use paediatric pads or a paediatric mode if available; if these are not available, use the AED as it is.

- Don’t use AED for children less than 1 year.

## AEDs in Transport

- You can leave the AED in place while transporting the patient.
- Avoid pushing the "analyse" button during transport.


95

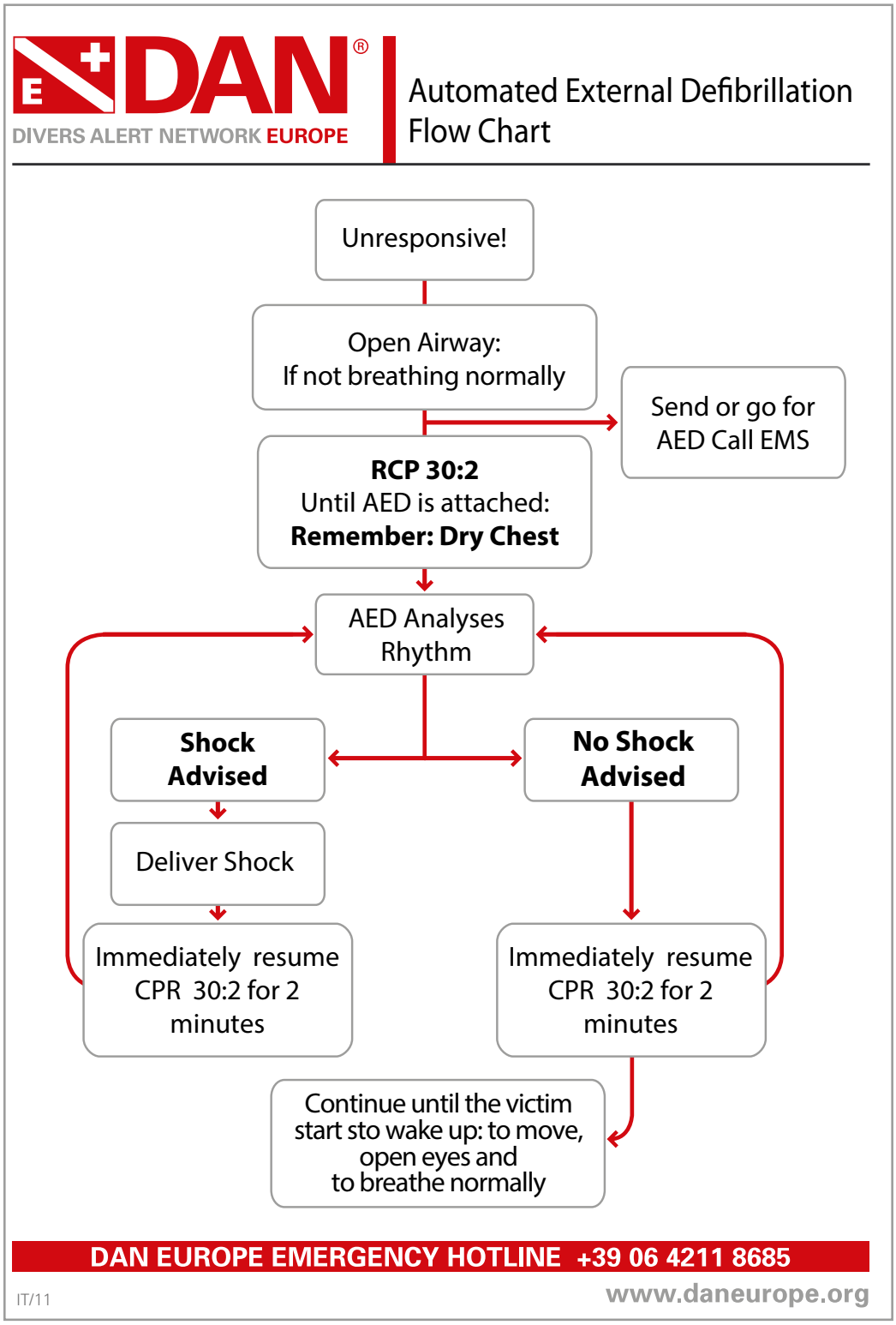
- The movement of the boat / ambulance can simulate a shockable rhythm and cause the device to call for a shock (Pic. 95).
- If shock is called for during transport or if the AED prompts the rescuer to check the patient or recommends a shock, stop the vehicle, then reanalyse.
- See manufacturer recommendations for other considerations.

## Troubleshooting

- Most AEDs will prompt the user as to the nature of the problem and provide directions to fix it (Pic. 96).
- Stay calm and listen to the voice prompts.
- Pad-related problems are the most common:
  - Be sure to press firmly.
- Lose pads may spark.
- Check for obvious signs of damage.
- Make sure cord is fully inserted.
- Poor contact due to hair:
  - Shave chest area where pad is placed.
- Wet skin:
  - Dry chest with a towel or cloth.
- Electrode pad adhesive dried out:
  - Use a new set of pads.
- Analysis interrupted:
  - Stop all movement.
  - Don't touch the patient.
- Radio Interference from radios and cell phone:
  - Keep them at least 1,8 meter / six feet away from the AED.

96

# AED Flow Chart




Source: AED Algorithm, ERC guidelines 2015

# Section 10

## REVIEW QUESTIONS

1. **Sudden cardiac arrest include _____ and _____.**

2. **Warning signs include: (Check all that apply)**
   - ◯ Heavy pressure in the center of the chest behind the breastbone
   - ◯ Sholder, arm, nek or jaw pain and discomfort
   - ◯ Shortness of breath
   - ◯ Sweating
   - ◯ Nausea and vomiting
   - ◯ Denial

3. **When defibrillation is provided within the first minutes after VF begins, the person has a very high _____ rate.**

4. **There are 4 links in the chain of survival: _____, _____, _____ and _____.**

5. **You should continue to provide CPR: (Check all that apply)**
   - **a.** Until AED arrives, set up and ready to use
   - **b.** After 2 consecutive shoks with no response
   - **c.** After 1 shock with no response
   - **d.** After no shock advisory, when victim is not breathing normally

6. **The first step to take in order to provide first aid with an AED is the _____ _____ assessment.**

7. **While you are waiting on another rescuer to set up the AED, what is the ratio of compressions to breaths for the one rescuer CPR?**
   - **a.** 5:1
   - **b.** 15:1
   - **c.** 30:2
   - **d.** 5:2

**Review answers are on pag 79**

?

8. **To attach the defibrillator pads to the person in cardiac arrest, you have to bear the chest and make sure the chest is_____.**

9. **One pad goes on the upper chest, just below the collarbone and to the right of the breastbone. The other pad goes on the lower _____ , just below the _____.**

10. **True or False: To ensure good contact with the pads, you should hold them down to the patient's chest during the shock.**

11. **True or False: To ensure good contact with the pads, you should hold them down to the patient's chest during the shock.**

12. **Most of the problems experienced with the AED are with the pads, some of the more common problems to be aware include: (Check all that apply)**
    - **a.** Obvious signs of damage
    - **b.** Poor contact due to hair
    - **c.** Radio interference from radio's and cell phones
    - **d.** Chest to dry

13. **AED 's are designed to require minimal maintenance. You should regularly check: (Check all that apply)**
    - **a.** The batteries to make sure the unit is ready to use
    - **b.** The expiration date on the pads to make sure they are ready
    - **c.** The additional components of the kit so everything is there when you need it

**Review answers are on pag 79**

# Regulatory Issues

Regulations and administrative codes vary widely, so you should always check with your DAN Europe Regional Office for more specific information for your area on obtaining an AED unit and any restrictions on its use.

However, there are no cases where lay rescuers have been successfully sued for providing care with an AED. Many countries have a Good Samaritan Law designed to protect rescuers who:

- Vrijwillig hulp verlenen en niet volgens de wet verplicht zijn dat te doen;
- Niets ervoor terug verwachten;
- Niet duidelijk nalatig zijn.

In zijn algemeenheid gelooft DAN dat AED's een belangrijke stap vooruit zijn in de eerste hulp aan mensen met een plotselinge circulatiestilstand. Ze zijn al op vele plekken aanwezig, cruiseschepen, luchthavens, vliegtuigen, casino's en veel andere plekken waar mensen samenkomenr.

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# Additional information

## 1. First aid courses & refresher training

This book and the DAN BLS course do not provide complete first aid training, but is limited to BLS techniques used to provide first aid for life threatening injuries.

By following a general first aid course you will also be trained to provide first aid for non life threatening injuries or sickness.

Other first aid courses, like an AED or Oxygen administration course will increase your knowledge and will improve the quality of the first aid provided. It is recommended to follow these courses (Pic. 97).

Also important is keeping a good level of training. Participation in a refresher course is encouraged and should be done at least once every 2 years to maintain a good level of competence. This will also increase confidence when providing first aid.

## 2. Moving an injured Person

It is recommended to leave a responsive injured person in the position in which he is found, specially when he is the victim of an accident (trauma) and a back or neck injury is suspected.

In some cases however it might be necessary for the rescuer to move the victim in order to assess breathing, provide first aid or because there is a danger, like for example a fire, present.

Victims can be moved quickly by using the Rautek technique (Pic. 98):


Pic. 97:
It is recommended to get trained as a DAN Oxygen Provider


Pic. 98:
Rautek technique

- Go with your arms under the arm pits of the victim, between his arm and body.
- Bring one of the victim's arms in a right angle in front of his body.
- Place your hand with closed fingers over the underarm between his elbow and wrist.
- Stand close to the victim  and place your feet at both sides of the victim's body.
- Pull op the injured person by stretchng your legs, while keeping your back as straight as possible (to avoid injury to your back)
- Pull the victim away from the danger. Keep the distance that you carry the victim as short as possible (just outside the danger zone is enough).
- Place the injured person on his back on the floor.

If the injured person is sitting down it will be easy to use this technique. If the person lies on the floor you must first:

- Turn him on his back, if needed.
- Kneel at the left side of the victim, next to his shoulders
- Go with your right hand under the victim's neck and grab his arm pit with your hand (fingers)
- Place your left hand in the left arm pit
- Bring the victim in one fluent movement in a sitting position by lifting him with your arms and positioning yourself close behind him.

## 3. Other techniques

The arm drag is another technique that could be used for emergency moves. In this case you can drag the injured person by his arms, while he is still on the floor (Pic. 99).

An alternative is to drag him at his clothes.

## 4. The use of  a stabilisation board

The use of a back board could be useful when more than one rescuer is available.

The back board will avoid back and neck movement during transportation, but is normally not available for during first aid (Pic. 100).


Pic. 99:
Arm drag


Pic. 100:
The use of a back board

# 5. Spinal Injury Management

Trauma to the head, neck and/or back can be expected when a person is the victim of a traffic accident (crash) or when a person fell (or dived) from a height with a severe blow or strong impact as result. It might also be caused because an object fall upon a person. In these kind of accidents a spinal injury is a concern for the rescuer.

The spinal cord can be found inside the spinal column and is a bundle of nerves, taking care of the communications (sending out impulses) between our brain and the rest of the body. A damaged spinal cord and/or column it might lead to paralysis.

It is therefore important not to move a person with a suspected spine injury as movement might make the condition of the victim worse.

When a victim is responsive you should therefore leave him in the position in which he is found and you should stabilise his head by holding it still with your hands on each side of the injured person's head (preventing movement), while waiting for the EMS to arrive.

However, when the victim is unresponsive, you would need to turn him on his back in order to open the airway, assess breathing or start CPR. When this is done, movement should be limited to a minimum.

When the victim is already on his back, you can open the airway as seen before. If breathing is present, stabilise his head, but do not place him in the recovery position.

If no breathing is present, provide CPR as learned before.

# 6. Log Roll

If the Inured person is not on his back, you should need to roll him in that position, while avoiding movement of the neck and back as much as possible:

- Kneel at the injured person's side.
- Carefully straighten the victim's arms and legs: place the arms close against his side.
- Support the head and neck with one hand.
- Place the other hand on the far away elbow and squeeze it gently into his side.
- Roll the victim towards you, while avoiding to twist his head, neck and back.
- Bring him first on his side, while making sure movement is limited to a minimum and then roll him further onto his back.

**Notes**

- When 2 rescuers are present, one can immobilise the head while the second person rolls the injured person on his back.
- This technique can also be used when a person is on his back and need to be turned onto his side to clear the airway from fluids.

# 7. Home Emergency Plan

When an accident happens at your house you should have emergency contact details within reach. It will only save valuable time but it might also be possible that, should you not able yourself, your child or another family member will need to call the EMS and doesn't know all needed details.

It therefore is recommended to have this info close to your phone and teach your child what to do and who to call in case of an emergency.

A example of a Home Emergency Plan can be found on the last page of he books and can be personalised fir your use.

# 8. Kit di primo soccorso (First Aid)

A First Aid Kit should be suitable to fulfil the personal needs or those of the environment where the kit will be used (Pic. 101).

The basic content of a first aid kit should allow us to provide BLS and first aid in a safe and effective way.

The following items should be a part (minimal) of a standard first aid kit:

- Protective case (waterproof is used in wet environments)
- Resuscitation barrier device (like face shield)
- Medical gloves
- Cleansing wipes
- Sterile saline for wound irrigation
- Bandages
- Sterile dressings of various sizes
- Sterile gauzes (can be a part of the dressing)
- Sterile eye pads
- Adhesive tape
- Scissors (strong enough to cut away clothes)
- Triangular bandage
- Safety pins
- Tweezers
- Adhesive dressings (several sizes)

Optional, but recommended are:

- Wound closure strips (suture strips)

- Irrigation syringe
- Disposable razor
- Cold and Hot compress
- Isothermal blanket
- Infectious waste bag
- Splint to immobilise fractures
- Oronasal resuscitation mask
- First Aid manual
- A list with emergency numbers

Because there might be legal restrictions in the use or sales of medication (and ointments), these are often not present in purchased first aid kits. They can be obtained in the pharmacy and added to the personal first aid kit if wished.

Recommended medications are:

- Antiseptic solution
- Hydrocortisone ointment
- Antibiotic ointment
- Eye wash
- Antihistamine tablet
- Pain reliever

In several countries it is however forbidden to administer medications to others as they may cause allergic reactions.


Pic. 101:
A First Aid Kit should be suitable to fulfil the personal needs or those of the environment where the kit will be used

# Divers Alert Network

Founded in 1980, DAN is an international, non-profit dive safety organisation, committed to improving diving safety and to conducting dive research.

IDAN (International DAN) with its headquarters in the USA and affiliates in Southeast Asia-Pacific, Japan, Southern Africa and Europe can assist you in the unlikely event of a scuba diving accident or injury.

While the DAN Europe headquarter is located in Italy, DAN Europe also has regional offices most European Countries and has affiliates in Egypt, Israel and the Maldives.

DAN also consults with the emergency medical professionals who continue care after your initial first aid.

If you suspect you've been injured while scuba diving, you can call the DAN Diving Emergency Hotline. DAN provides this service to the diving community 24 hours a day, 365 days a year to assist and help arrange for evaluation and treatment of injured divers. Whenever you need help, DAN is there for you.

DAN also works to prevent diving injuries and accidents. If you have a question concerning diving medicine, dive safety, fitness for diving or for a referral to a physician knowledgeable in diving medicine, you can call the DAN Dive Safety and Medical Information Line.

DAN also conducts research on scuba diving such as the DAN Diving Safety Laboratory and looking into how flying after diving and various environmental and physiological conditions may affect diver health.

Another way DAN improves dive safety is through training and education. DAN has developed an Automated External Defibrillator programme, oxygen first aid programmes and related oxygen delivery equipment to promote the benefits of emergency oxygen first aid for injured divers. DAN also offers training programmes for physicians and emergency medical services personnel.

DAN provides these valuable services to the entire dive community because of the support of the world's largest association of recreational divers, the DAN membership. For an annual fee, DAN members receive many valuable benefits including dive accident insurance, Alert Diver, diving's leading safety magazine; DAN Travel Assist, access to potential evacuation in a medical emergency when you travel, and others.

DAN is Your Dive Safety Association!

# BLS/BLSD Review Questions: Answers

## Section 1:

1. a
2. a
3. c
4. c
5. b

## Section 2:

1. Early Access to the EMS, Early BLS, Early defibrillation, Early Advanced Life Support.
2. Chest compressions - rescue breaths.

## Section 3:

1. ABC's or vital functions
2. 21, 16-17, oxygen
3. Heart, blood flow, oxygenated, vital
4. Preserve, prevent, provide
5. e
6. b
7. Permission, "My name is ……and I am a DAN First Aid Provid-er. Can I help you?"

## Section 4:

1. Fire, electricity or gas, traffic, chemicals, animals
2. Blood, vomit, body fluids
3. Gloves, resuscitation barriers and eye protection
4. Cleaned, disinfected
5. Gloves

## Sezione 5:

1. a
2. Avoid long, rapid or forceful rescue breaths, open the airway completely, allow the chest to fall back in the normal position before giving the second rescue breath, avoid putting pressure on the stomach, watch the stomach for signs of overexpansion
3. Turn the victim on his side and clean the airway
4. Calm, victim, at a distance
5. a
6. 1
7. b

## Section 6:

1. a
2. a
3. Jnjured
4. b

## Section 7:

1. Food, toys
2. a
3. c
4. Speak, breathe, cough, consciousness
5. a
6. 5 back blows, 5 abdominal thrusts
7. Start CPR

## Section 8:

1. a
2. Oxygen, bacteria and viruses, clotting
3. Dark, flows steadily, bright, spurts
4. a
5. b

## Section 9:

1. Shock is a life threatening condition caused by an inadequate oxygen supply to the major body organs
2. Severe, fluid loss
3. Hypovolemic, Cardiogenic, Septic, Anaphylactic, Insulin and Neurogenic Shock
4. Rapid and weak pulse, pale and cold skin, clammy skin, thirst, nausea and vomiting, enlarged pupils, weakness and unconsciousness
5. External bleeding, floor, elevated, oxygen, body temperature
6. b
7. a

## Section 10:

1. Heart disease and electric shock
2. All
3. Survival
4. Early access to EMS system, Early CPR, Early Defibrillation and Early advanced Life Support
5. a, c and d
6. Scene safety
7. c
8. Dry
9. Left – breast
10. False
11. True
12. a - b - c
13. a - b - c

# Home Emergency Plan

## When you recognise that an emergency exists:

- Dial:

_____

*(Write the national EMS number above)*

- The EMS will ask you: “what is the emergency?”
- Stay on the line, keep calm and follow instructions.

Your street address

Your phone number

- Ife possibile manda qualcuno fuori a incontrare il SME in arrivo.

## Additional Important information

National Poison control centre:

House Doctor:

Neighbour:

Family member:

# DAN Courses


Oxygen First Aid for Scuba Diving Injuries


Advanced Oxygen First Aid


On-Site Neurological Assessment for Divers


Medical Oxygen Rebreather

Oxygen First Aid for Aquatic Emergencies



Basic Life Support/BLS-D/PBLS-D

First Aid

First Aid for Hazardous Marine Life Injures

Dive Medicine For Divers


Dive Medical Technician

Fire Safety and Emergency Management Officer

Diving Center Operator

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