Scuba Safety & First Aid

Prevention

First Aid

Assist & Rescue

Managing Emergencies

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Scuba Safety & First Aid
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Introduction

Describe the intended scope of the Scuba Safety & First Aid programme.

The Scuba Safety & First Aid course prepares divers for better understanding and fulfilment of their responsibility toward other divers. The program aims to increase awareness of factors that can complicate a dive. This allows divers to take actions that can help in preventing diving emergencies. Such a pro-active approach requires divers to be attentive and to think ahead. It represents a higher sphere of awareness. In the first sphere (Open Water Scuba Divers) divers tend to be oriented inward. They concentrate on their own actions. In the next sphere (Basic Advanced Open Water Diver) they increase their awareness of their surroundings. This next step helps divers to be more aware of the actions of others.

No matter now attentive we are emergencies can always arise. The second part of the Scuba Safety & First Aid program teaches techniques for first aid, diver rescue and managing emergencies. The Scuba Safety & First Aid program combines diver rescue with general first aid and therefore counts for the first aid training requirement that is in place for leadership level courses. Both first aid and rescue skills must be practiced on a regular basis. For that reason, an update program must be completed every two years. The minimum age to participate in this course is 12 and the minimum certification level is Basic Advanced Open Water Diver.

Preventing Diving Emergencies

Emergencies in diving are often related to either equipment, the ability of the diver to cope with the conditions of a dive, or to an inability to perform a required skill. Any preparation to prevent diving emergencies must therefore address these three aspects. Most diving emergencies do not happen all of a sudden. An emergency is almost always caused by a chain of events that was started by a minor problem. As a consequence, the prevention of diving emergencies involves early recognition of such minor problems.

To improve the ability of a Scuba Safety & First Aid certified diver to prevent small problems from becoming big problems, information is needed. This chapter addresses the mechanisms behind stress, its recognition and strategies to improve evading stress or coping with stressors. The role of training is addressed with emphasis of the importance of training outside of courses. In the last part of this chapter, equipment related problems are addressed by improving the knowledge of potential complications.

Describe what characterises diving emergencies that could have been prevented.

All diving emergencies are unique. In hindsight, many could have been prevented while for some others prevention would have been unlikely or even impossible. A diver can mark a site with a dive flag, ascend with one hand over the head to prevent bumping into something and make a 360 degree turn to verify the surface before ascending the last few meters. All those preventive measures cannot avoid being hit by the board of a wind-surfer who is unaware of the meaning of a dive flag. Freak accidents can and will happen. They cannot be prevented, but fortunately they are extremely rare.

Many accidents can be prevented. These are generally incidents at the end of a chain of events. If a diver runs out of air, monitoring of the SPG has been inadequate. When a diver panics, mounting stress has gone unnoticed. If equipment fails, it has likely not been adequately checked before use. If a diver experiences problems in reacting to a minor problem, reviewing skills has probably not received the attention it needs. Often emergencies happen because of a minor inconvenience. If the minor inconvenience is not dealt with or cannot be dealt with, the chain of events leading to an emergency is set in motion. Preventing emergencies does require a diver at the level of Scuba Safety & First Aid to be attentive. Early recognition of minor problems and reacting to them in an appropriate manner go a long way in the prevention of many diving emergencies.

List three categories of problems that require the attention of a diver at the level of Scuba Safety & First Aid.

In order to deal with minor problems or inconveniences that have the potential of starting a chain of events, you need to know what to look for. An initial category of problems relates to the state of mind of a diver. Stress can develop into panic and must thus be dealt with before it gets to that point. An inadequate level of diving skills can complicate harmless situations and hence is the second category. The third category consists of equipment related problems. Equipment can malfunction, but problems can also arise from using the equipment incorrectly or selecting the wrong equipment for the dive to be made.

Describe what stress is and how it can develop into panic.

Stress is a negative influence that has an impact on a diver's mental and/or physical well-being. The normal state of well-being is disrupted by environmental, internal or external stimuli. These stimuli are called "stressors". If the stressor affects mental well-being, the diver will have mental stress, if the impact is on physical well-being, the diver will have physical stress. Physical stress itself is in turn a stressor that can trigger mental stress.

Physical stressors include ambient temperature, strenuous activity, illness, hunger, thirst, pain or injury, uncomfortable equipment or any other factor that directly influences our body. The point at which a physical stressor starts to cause evident physical stress varies from person to person. Individual susceptibility depends on the ability of that person to cope with a stressor. Coping can be seen as the ability to ignore a stressor or to dismiss it as inconsequential. The ability to ignore a stressor does (among other factors) depend on your physical condition.

Mental stressors are more difficult to grasp. Ambient disturbances such as loud noise, the behaviour of other people or a hurried crowd can be (external) mental stressors. Internal stressors include doubts about one's own abilities, fear of darkness, small spaces, depth or other. Many mental stressors have both an external and an internal component. This goes back to the notion that a psychological situation is only stressful when it is appraised as such. A situation which is nonthreatening for one person may be stressful for another. People vary in their appraisal of situations. To recognise a situation which is stressful for a diver, paying attention to possible stressors is not enough. To recognise mental stress, the reactions (or absence thereof) of a diver should be taken into account.

Confronted with a stressor and experiencing the anxiety related to stress, a diver will try to engage in some sort of corrective action. If such an action is successful, the stressor is dealt with. The action can involve a better way of coping with the stressor, but it can also be evasive. Evasive action can involve getting out of (perceived) harm's way by aborting the dive or not entering the water in the first place. In some cases divers are unsuccessful in formulating corrective action. In other cases they simply make the wrong choice and decide for an action that actually makes things worse. If a diver fails to engage in effective corrective action, anxiety mounts and will eventually lead to panic.

Panic refers to a diver who reacts through instinct and fear. Rational responses to instructions cannot be expected. The diver will not take the initiative for corrective measures and would rather swim until exhausted than thinking of dumping weights or inflating a BCD. The diver is totally overwhelmed with the situation. Panic in the water is a life threatening situation. To prevent a diving emergency, it is important to be able to recognize mounting anxiety before it develops into panic. The time for stress to develop to that point varies widely. Stress can develop into panic in as little as a minute, or it can take until the dive is almost finished (although the stressor was present since the start).

In itself, stress is not a bad thing. It is a natural reaction of the body and mind to the presence of a stressor. The anxiety is meant to alert us for the need to cope with the situation. A little stress keeps you on edge. It will make the way you deal with a situation more efficient. Stress only becomes an issue if anxiety mounts unchecked, if no coping or evasive strategy is found, or if the stress is dealt with in the wrong manner.

Describe options a diver has to improve the ability to cope with stressors.

A situation is only stressful if it is appraised as such. Fear of the unknown and doubts in your abilities to see a situation through can substantially contribute to stress. Improving the ability to cope thus involves increasing the number of situations that you are familiar with, and developing confidence in your own abilities. Part of improving your ability to cope with stress is thus to dive as often as you can in as wide a variation of conditions as possible. Fear of the unknown diminishes with experience. Dive whenever you can in a variation of weather and diving conditions. Take it step-by-step. You should not progress from comfortable and controlled conditions to harsh situations in one go. Develop your range of conditions by slowly progressing until you find your personal limits.

There is only one way to develop confidence in your own ability - practice. Improving your breath-holding time underwater helps you to be confident that you can reach the surface when your air supply is disrupted. Practice buoyancy skills to be confident that you can stay at any depth you wish. Improve your physical condition by snorkelling on a regular basis so that you are prepared to fight a current when needed. Practice general diving skills with your eyes closed to eliminate doubts that you cannot handle loss of visibility. Try new techniques or different ways to handle a problem, improving your ability to improvise should your first solution for a problem not work.

Physical stressors are probably easiest to avoid. Only go diving when you feel good. Do not dive with an empty stomach and drink enough water to avoid dehydration. In cold conditions keep yourself warm before the dive starts and wear enough exposure protection during the dive. If it is warm, avoid overheating before entering the water. Make sure that your equipment is in good working order, of the correct size and appropriate for the diving conditions.

Describe how to recognise stress in another diver and what to do if indications are discerned.

On land, before a dive, stress can be recognised by checking for a wide range of symptoms. For a third party, behavioural symptoms are often easiest to recognize. These include isolating oneself from others, nervous habits (pacing, biting nails, etc.), neglecting responsibilities or changing eating, smoking and talking habits. Emotional symptoms include moodiness, being irritable or short tempered, being unable to relax or agitated and being depressed. The affected diver may feel overwhelmed, lonely or isolated or have a general feeling of unhappiness. These last symptoms are hard to recognize for a third party. The same goes for physical symptoms such as rapid heartbeat, nausea or dizziness.

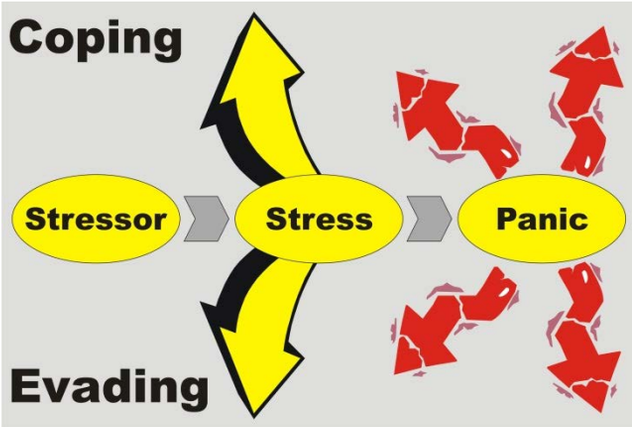
Underwater, cognitive symptoms are often the best indicator. Poor judgement, memory problems, and an inability to concentrate can be noticed in the actions of a diver. Reacting to hand signals, timely adjustment of buoyancy, sticking to the dive plan and other behavioural signs are part of “what a diver does”. Any absence of expected behaviour or delays in behaviour is an indication that the diver is preoccupied. They are an indication of a heightened anxiety level. In addition to absence of expected behaviour, the diver may display behaviour that is an indicator of what the stressor is. Hugging oneself when it is cold, holding on to the wall because of fear of sinking, diving shallower than the rest of the group because of lack of confidence, holding on to the regulator or inflator and so on.

Describe what you should do if you recognise indications of stress in another diver.

If you suspect a diver to be anxious about an upcoming dive, you should talk with the diver. All symptoms of stress have one thing in common. They are not exclusive. What you identify as an indication of anxiety for a dive can in fact be something completely different. The diver may be withdrawn because he is thinking about better preparations for the dive. Being moody may be the “normal” behaviour for that specific diver. Rather than neglecting responsibilities, the diver may simply not have been informed of what was expected of him. The general idea is to talk with the diver to find out if your suspicions can be confirmed, rather than talking to the diver about his (presumed) anxiety. You could start a dialogue simply by asking if the diver has been at this site before.

If your suspicion of heightened anxiety is confirmed, there is not yet reason to worry. Some divers are tense before they enter the water and relax as soon as they take their first breath from the regulator. If the heightened anxiety is related to a specific stressor, the situation must be dealt with. Since poor judgement and inability to concentrate are symptoms of stress, the diver himself may not be able to develop a strategy to deal with the stressor. You may be able to offer advice.

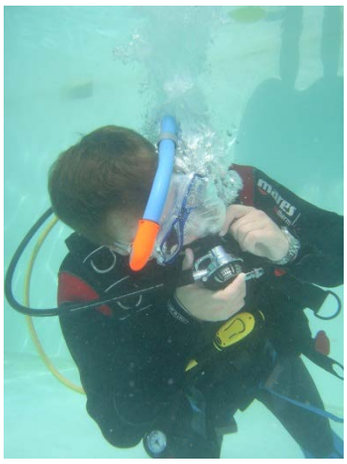
Strategies to deal with a stressor fall into one of two categories. These are techniques of coping with the stressor and possibilities of evading the stressor (sometimes called fight or flight). Coping may involve actions to improve confidence, such as clear information on what to expect (to overcome fear of the unknown). Evasive strategies may involve adapting the dive plan. Agree to stay at shallower depth, agree not to start the dive against the current or simply agree to give it a try, knowing that the dive can be aborted at any time (even after just entering the water). Evasive action also includes not participating in the dive at all.



Underwater, more decisive action may be needed. If anxiety has developed to a level that it is noticed by another diver, no time should be wasted. A strategy to deal with the stressor must be put in motion. In most cases ascending to shallower depth is advisable as a first step. For many divers being closer to the surface gives a feeling of being in control. Feeling in control can help to reduce anxiety. As long as the specific stressor is not identified, a strategy for coping or evading will not make much sense (other than evading all stressors by aborting the dive). There are however situations in which the stressor is obvious. Such obvious stressors can be cold water, strong current or high waves. These are stressors that affect all divers and are thus real, rather than perceived. If it is obvious what the stressor is (and if the other diver confirmed this), you might be able to propose a coping strategy. If not, abort the dive.

Describe the role of training in the prevention of diving emergencies.

Although the name would indicate differently, most parts of diving courses have little to do with learning to dive. Already in beginner courses, a substantial part of the training is dedicated to dealing with unexpected situations. Clearing a mask of water is not diving and neither is the recovery of a regulator. Diving is about swimming underwater, having control over direction, staying with a buddy and similar things. Skills to prevent emergencies are learned in order to handle inconveniences in such a manner that an adverse situation can be solved. These are not "diving skills", but skills that are done when something hinders the normal continuation of the dive.



An inability to perform the needed skill to deal with an unexpected situation can lead to a diving emergency. If a problematic situation cannot be dealt with adequately, a chain of events may be triggered. It is often not the initial problematic situation that leads to an emergency, but rather the chain of events that follows. A simple inadequacy in skills can lead to heightened anxiety and that can in turn lead to panic. Problems with buoyancy control can cause a diver to sink deeper than intended. Associated attempts to swim to a shallower depth can in turn provoke a leg cramp. The leg cramp can then prevent the diver from avoiding to sink. As a result the diver may only have the option of taking more drastic measures (overinflating the BCD or ditching weights), leading to an uncontrolled ascent.

Amongst other objectives, diver training is meant to teach the techniques that are needed to cope with unexpected situations underwater. Some of these techniques are general, such as clearing a mask of water, recovering a lost regulator or releasing a cramp. Other techniques are related to the challenges of specific diving circumstances. Entering the water through surf, controlling depth and direction in (very) low visibility or switching to a secondary regulator (closing the other valve) in cold water belong in this category. A final category is about the skills needed to engage in special activities. This includes line signals used for communication between a line tender and divers under ice. Diving at drop-offs or in blue water, dealing with a run-away lift bag in search and recovery, handling a feet-up situation when diving in a dry suit or signalling an emergency at night are other examples.

The above examples illustrate that diver training has three roles with respect to preventing emergencies. Starting with a beginner course, divers should learn the general skills needed to handle general problems that could occur on any dive. Dive professionals must also offer programs that allow divers to keep these skills sharp. During any course, diving professionals must add specific local techniques to deal with the prevailing dive conditions. Divers must be aware of the importance of such techniques and seek an introduction to local diving circumstances when visiting a new dive location.

Lastly initiations and courses for special activities must teach techniques related to that activity. Next to any special techniques related to the activity itself, a diver must be able to perform all skills required for an Open Water Scuba Diver while engaging in the activity. A photographer should be able to do those skills while holding on to the photo equipment, a dry suit diver should be able to perform the same skills in a dry suit as he is able to do in a wetsuit. Divers should understand (and respect) that engaging in new activities comes with a requirement to complete additional training.

The role of training in mainstream courses is thus to teach general techniques and to aid divers in dealing with local diving circumstances and challenges. As general skills are to be kept up-to-date, review programs are available. As circumstances vary, initiations (either formal or informal) to new circumstances are offered. Mainstream courses are Scuba Diver, Open Water Scuba Diver, Advanced Scuba Diver and Scuba Safety & First Aid. Training to deal with the challenges of special activities are part of initiations and courses for each specific activity.

The word “training” might be taken to imply that a diver is a (more or less passive) receiver of training offered by an instructor. This is not the case. The responsibility for training lies both with the instructor and with the student. You train to improve your tennis game when you are with a trainer or instructor, but also when you yourself spend an hour playing balls against a wall or playing some games against a friend. School cannot prepare you for all aspects of the work in your first employment. Without “training on the job” your value for your employer is limited at best. Diving is no different. Training during courses is only one part of the learning process. Divers must be curious and take a pro-active approach to learning. Observe others and discuss what you see. When using new equipment, assure that you can do all you could with your old equipment. Read books and articles and take benefit of all learning opportunities.

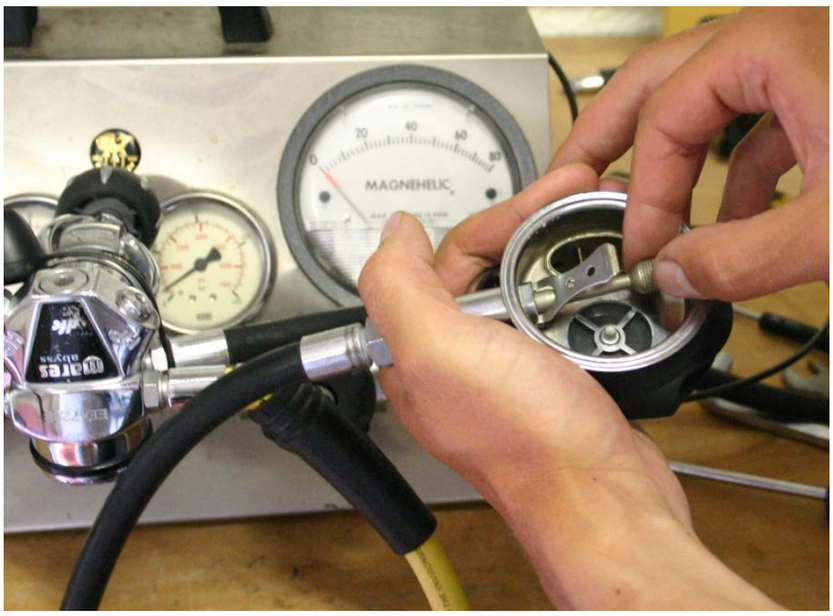
Equipment related problems can be grouped in relation to one or more categories. These are:

Describe the categories in which equipment can cause (or be a contributing factor in) diving emergencies.

- Technical problems with the functionality of the equipment.
- Functional equipment items that are combined with items with which they are not compatible.
- Equipment that is not appropriate for the prevailing diving conditions or activity.
- Equipment that is not appropriate for the diver.
- Wrong use of (or unfamiliar with) the equipment.

Often equipment related problems are reported as either the initiator of a chain of events leading to a diving emergency, or as a contributing factor. Examples of equipment problems as an initiator include an SPG giving wrong readings, using a suit that does not provide sufficient thermal isolation, or a regulator mouthpiece separating from the second stage during a dive. Examples of equipment as a complicating factor include a stuck weight belt buckle, a fin strap that breaks when a diver puts more strain on the fins to get out of a dangerous situation, or a regulator that freezes up when a diver (who failed to adjust buoyancy) gets out of breath while finning to prevent sinking deeper.

Equipment should not only be "good enough to dive with", but should also (or especially) function flawlessly when dealing with an emergency, or when adverse circumstances increase the strain put on the equipment. In order to prevent equipment related problems, a diver must have a thorough knowledge of equipment functionality. With equipment, you always have to ask yourself "what if . . ." Both selecting and inspecting equipment should be done with the most adverse circumstances in mind.



Give examples of technical problems with the functionality of equipment.

Diving equipment requires maintenance. If equipment is not adequately maintained it may malfunction. There are clear recommendations for the maintenance of regulators and cylinder valves. Both should be serviced every year (more often if used intensively). Periodic service includes taking the item apart and cleaning the individual parts. In the process, defined parts (O-rings, filter and valves) are systematically replaced. Other parts (hoses, mouthpieces and other) are only replaced if they show substantial wear. Diving cylinders are subject to periodic testing. These tests are required (by a government body outside of the diving industry) and involve testing the cylinder at a higher pressure than its normal working pressure. In the diving industry it is common to do additional visual inspections. Visual inspections are done every year, while the interval for testing under pressure varies from country to country.

Having equipment services according to requirements and recommendations is not enough. For most of the equipment, including mask, fins, suits, weight belt, computer, BCD and other, there are no (clear) requirements or recommendations. The equipment for which recommendations are in place can expe-

rience problems in-between servicing. In addition to servicing equipment, divers must inspect and maintain their equipment on a regular basis.

Describe examples of the limits for combining different equipment items.

Not all equipment is compatible. When changing one equipment item, there may be a need to change other items as well. BCDs vary in volume. A BCD that you bought for dives in tropical areas will most probably have a relatively small volume. When expanding your experience to diving in cold water, you will use a much thicker suit. The substantial compression of the suit with increasing depth will require a larger BCD volume to compensate for loss in buoyancy.

A thicker suit will also require you to use more weights. A simple weight belt may be sufficient for warm water diving, but the number of weights required in cold water could overload the belt buckle. It would therefore be an advantage to have a BCD with an integrated weight system. That way the diver could wear part of the weights on a belt and the rest in the BCD. In an emergency an uncontrolled ascent can then be avoided by dumping only part of the weights.

Each brand of regulators has its own intermediate pressure. Many first stages can be adjusted to supply another intermediate pressure to the second stages, but the second stage itself must be used with the intermediate pressure it was designed for. If an alternate air source is attached to the same first stage as the primary second stage, both must be of the same brand. If different brands are connected to the same first stage, only one can be adjusted correctly. The other second stage cannot be expected to function as well as it would with the correct intermediate pressure.

Dry suits have rather few consequences for other equipment items. Regulators must supply an additional inflator hose and the previously mentioned considerations for thicker suits apply. Since dry suits have integrated booties, a need for a bigger size of fins is also likely. Equipment considerations for dry suit diving are covered in the dry suit initiation.

Describe how to establish if equipment is appropriate for the prevailing diving conditions and/or activity.

Equipment must be adapted to the diving conditions and activity. Diving in cold water is a good example. Regulators can freeze. The first step to prevent regulator freezing is assuring an air supply that is completely dry. This requires a visual inspection of the cylinder before the cold season and of the filter of the compressor used to fill the cylinder, to verify that it is in good condition. The second point of attention concerns the second stages. Both second stages must have good thermal conductivity. Metal and carbon second stages work well. Plastic second stages can be equipped with metal add-ons to improve conductivity. For diving in cold water it is recommended to have two first stages (one for each second stage). This allows turning off the air supply to one of the regulators while the other stays fully functional.

The example of cold water diving should show that it is not easy to decide if equipment is appropriate for the prevailing conditions (or activity). Cold water comes with an increased risk of regulator freezing, but that does not mean that they would freeze on every dive. If you have bad luck they would only

freeze when you could least use the added complication. The risk of freezing depends on depth, moisture in the air in the cylinder, as well as how often and deeply the diver is breathing. An inadequate regulator could thus freeze at greater depth while you vigorously swim in an attempt to bring an unresponsive diver to the surface. That same regulator could function perfectly when you try it in shallow depth in an attempt to verify if it is adequate for the local conditions. Appropriate equipment functions not only if the dive goes as planned, but also functions in exceptional circumstances (within reason).

Since testing equipment in person is not always the most reliable source of information, you must rely on the experience of others. Knowledge regarding appropriate equipment choices develops over time. At most locations, divers will, over the years, have accumulated thousands of dives. This is the best imaginable test of appropriate equipment configurations. If you take-up diving in conditions that are unfamiliar to you, or if you participate in new activities, then you should consider experienced local divers to be an important source of information. Some choices are obvious. This includes taking a bigger cylinder for a deep diver or a thicker suit for colder water. Information from other divers can help for less obvious choices.

Describe how a diver's training, experience and physical condition can be a limiting factor for the equipment that is being used.

Most scuba units, suits, masks and fins used today are meant for general use. They are not intended for extended depth ranges, strong currents, extremely cold water or other adverse circumstances. Next to this "general" equipment, there are more specialised items. Longer or more rigid fins for increased propulsion, regulators with higher flow or freezing resistant features, or dry suits with full-face masks and attached gloves. Next to specialised standard equipment, there are also several add-ons such as torches, cameras, reels, metal detectors, lift bags and much more.

Both add-on equipment and specialised equipment can put additional demands on the diver using it. Long or rigid fins cause muscle cramp for the untrained diver. Cameras and other add-on items require a diver to do all general diving skills with one hand only. Regulators for extreme conditions can often not provide the breathing comfort a diver is used to from mainstream equipment. Taking add-on equipment on a dive or using specialised equipment can become a cause of diving emergencies. Any choice for equipment other than for general use must be accompanied by the needed additional training. Only divers with a reasonable amount of experience and appropriate physical condition should consider the use of specialised and bulky add-on equipment.

Give examples of wrong use of diving equipment.

Problems can also be the result of the wrong use of diving equipment. A typical example is only partly opening the valve of a scuba cylinder. This would allow a diver to comfortably breathe at shallow depth, but restricts the airflow at greater depth. The resulting overexertion can lead to panic and thus a diving emergency. There are several other examples. Rinsing a regulator first stage without the cover in place lets water enter the first stage. The next time the regulator is put under pressure this water can be forced into the SPG. This will cause the SPG to corrode and to provide wrong readings. The SPG would still indicate 20 or 30 bar when the cylinder is already empty.

Another maintenance related issue are the zippers of semi-dry suits. Such zippers can crack open in the middle of a dive if they are not maintained according to manufacturer recommendations. This in turn can cause hypothermia (loss of body heat). In addition to maintenance, there are numerous other examples of wrong use. Connecting the regulator to the cylinder the wrong way can cause hoses to be

wrongly positioned. The main regulator may be difficult to keep in the mouth, or the inflator is pulled high up the shoulder of the diver. Attaching a cylinder to a BCD with a strap that is completely dry can cause the cylinder to slip. Placing weights too close to a weight belt buckle can cause the buckle to open in the middle of a dive. It should not be hard to figure out some more examples in a "brain-storming" session with other divers. Such "what if" sessions help a lot to develop the needed awareness to prevent diving emergencies.

First Aid

This chapter addresses techniques to help an ill or injured diver. First aid skills are general. They can be used in any medical emergency – not only diving. However, there are additional considerations for divers that do not always apply in more "general emergencies". At the same time there are techniques that are unlikely to be of use in a diving emergency. In this chapter first aid is addressed in the context of diving. The skills learned will obviously be useful when confronted with a medical emergency at home or at work, but the main goal of this part of the course is preparation to deal with diving related emergencies.

This part of the Scuba Safety & First Aid course starts with medical situations that hinder the oxygen supply to the bodies tissues. A primary assessment should indicate if action is needed. Such actions are then addressed. The second part deals with medical problems that are not directly related to supplying the body with oxygen. Since their importance is less, they are addressed in a procedure that is named secondary assessment.

Describe the steps for dealing with a medical emergency.

Medical emergencies require an intervention by emergency medical services. Medical emergencies go beyond the point of requiring a bandage for a small cut or abrasion, or an ice bag to reduce a swelling after bumping your head. This does not mean that all medical emergencies are life threatening. As a matter of fact the number of emergencies in which a patient does not require basic life support is much more frequent than life threatening emergencies. The term medical emergency thus refers to medical problems for which the assistance of a medical professional is necessary. Of course, this includes respiratory arrest, but also a wound for which stiches are needed, a broken leg, or fainting for no apparent reason.

The first step in dealing with a medical emergency is to recognize that an emergency exists. This may sound easy, but that is not always the case. Some diving related problems interfere with the oxygen supply to a particular part of the body. Just as with a stroke, it could be that the skin looks perfectly natural (is fully oxygenated) while part of the brain is deprived of oxygen. The Oxygen First Aid course provides detailed insights for such oxygen related medical problems. Once a medical emergency is recognised, the medical emergency services must be alerted. Recognition of a problem, combined with alerting the emergency medical services are the most important steps in dealing with a medical emergency.

The next step would be a general assessment of the situation. In this step you identify any dangers for yourself and evaluate if the condition of the patient's spinal cord could be a complicating factor for providing help. Your personal safety has priority over helping the patient. Putting yourself in danger could complicate the situation from assistance for a single person to a multiple patient rescue operation. As part of assuring your personal safety, you should also decide if gloves or barriers are needed or desired.

If your assessment of the situation allows helping the patient, you begin with a primary assessment. If your primary assessment reveals any anomalies, you start an intervention. If no anomalies are found you move on with a secondary assessment. First aid measures are continued until emergency medical services arrive. At that point you hand over the patient and pass-on any information that is relevant for providing appropriate follow-up care. This information should not only take emergency care into account. The emergency services will pass on your observations to the hospital, so it should also include any information that is relevant for treatment, such as the profile of the dive.

The sequence of events is thus recognition that an emergency exists, alerting emergency medical services, doing a general assessment of the scene, providing help while waiting for the emergency medical services, and the providing all relevant information. From that point onward, professional medical services take over. That includes the emergency response team, the hospital, and possibly a recovery facility.

Describe what should be done after recognising a medical emergency.

As soon as you are aware that there is a medical emergency, you should contact the emergency medical services. You will need to inform them of your identity, the nature of the emergency, and

where you are. That last point may require some thought. Most dive sites do not have an address. It can be difficult to explain your location. This is (one of) the reasons why dive professionals have made it a habit to prepare an emergency plan for the dive sites they visit. In the plan they prepare information on landmarks, close-by known addresses, or GPS coordinates. After having given all information, you should not disconnect. You have to ask permission to end the call before doing so.

If you are alone, alerting the emergency medical services is a step to be completed before starting your general assessment. In most cases however one person could make the call while the other already starts with the assessment of the scene and possibly providing help to the patient. Even if you are alone, in some cases you could decide to prevent further harm before alerting the emergency services. This could include removing a patient from the water or starting a first cycle of CPR. The general rule is to first call and then help. Fortunately, in by far most cases, you will not be faced with such difficult decisions, as there are other people on the scene who you can ask to make the call.

Describe points to be taken into account during a general assessment.

The general assessment is meant to prevent an already bad situation from getting worse. It addresses the safety of the rescuer as well as indications that the patient may have damage at the spinal cord. An appropriate first step is the identity of the patient. If the patient is somebody you know well (family, a partner or other close relation), you are probably aware of any infectious diseases the patient may have. If you know that neither you, nor the patients pose a risk for disease transmission, the use of gloves and barriers may be considered optional. In all other cases, rescuers are recommended to wear personal protection.

Before approaching the patient, the rescuer should evaluate if the scene is safe. Look for cables that may have caused an electrical shock, traffic (cars or boats) that may be dangerous for the rescuer, gas that caused the patient to lose consciousness, falling objects and other dangers. The rescuer should make sure not to get hurt by the same cause as the patient. Evacuate any gases and switch off electrical sources if they are an issue. You should direct traffic around or away from the place of the emergency before approaching the patient.

Before starting primary assessment, your general scene assessment should be completed with looking for clues that lead you to suspect spinal injury. This is the case when a conscious patient complains of pain in the neck or back. Also when the patient does not feel such pain or is unconscious, there are indicators that should lead you to suspect spinal injury. A person, who has made a head-first dive in shallow water, has fallen from a height greater than himself, was struck by lightning or had a severe blow to the neck, head or back, must be handled with care. Traffic accidents, including being thrown from a vehicle, and other serious impact, should also be treated as patients with possible spinal injury. A last point of attention are wounds (penetrating or not) that lead you to believe that the spinal cord is affected. If damage to the spinal cord is suspected, you must slightly alter the way you provide care. These techniques are covered in the sections where care is explained.

Describe the purpose of a primary assessment and how this is done.

The cells in the human body need oxygen to survive. A primary assessment is done to verify if the distribution of oxygen in the body of the patient is sufficient. Primary assessment thus deals with life threatening situations. It addresses breathing, circulation, substantial loss of blood (the carrier of oxygen) and shock (problems with the distribution of blood in the body). Providing additional oxygen to aid the body in supplying all organs is also considered part of primary assessment. Primary assessment is not a "one time action". While taking care of a patient the assessment is repeated every few minutes to detect changes in the patient's condition.

Start by telling the patient who you are and that you are trained in first aid. Then ask the patient if you are allowed to help (if the patient is unresponsive you may assume consent). As a next step verify the level of consciousness. A coherent answer to your asking for permission to help is a sign of the highest level of consciousness. A garbled answer indicates a lower level. If the patient is not answering at all, you may tap the patients shoulder or try to get a reaction in another way. The lower the level of consciousness is, the more likely it is to find a problem with oxygen distribution.

If a patient is responsive, your primary assessment is limited to verifying substantial blood loss and preventing shock. Providing oxygen can also be taken into consideration. For an unresponsive patient you start by opening the airway and verifying breathing. If the patient is breathing, you may assume that the patient has circulation. Just as with a conscious patient you then move on to verifying blood loss, preventing shock and giving oxygen. If the patient is not breathing, you interrupt the assessment to start CPR. Techniques for the primary assessment and for turning a patient are learned in the practical part of the course.

It is easiest to do the primary assessment for an unconscious patient lying on their back. If you find an unconscious patient in another position, you may consider putting the patient onto their back before starting. However, if you suspect damage to the spinal cord, you do not turn a patient just for verifying that he is breathing! In this case you do your primary assessment in the position in which the patient is found. After finishing the assessment you may need to leave the patient (for example to attend to another patient). If you stay with the patient, there is no need to change the body position. If you need to go away, you should put the patient in the recovery position. Putting a patient in the recovery position should only be done as a last resort if spinal injury is not suspected.

Describe how to continue after completing primary assessment on a coherent patient suspected to have spinal cord injury.

If a patient seems to have adequate oxygen distribution, but is suspected to have spinal cord injury, protecting against further harm takes first priority. To prevent the patient from looking around (and by that putting strain on the spinal cord), you may kneel next to the patient and support the head in the position it was found. To prevent shock, you can support maintaining a normal body temperature. On

a hot sunny day, this may involve providing shadow. In cold weather you may provide additional insulation by putting a blanket or clothing over the patient.

While waiting for the emergency services you talk to the patient to monitor the level of consciousness. If there is a second helper, you may start on a secondary assessment for injuries. That assessment should be limited to actions that do not require moving the patient's body. Again, protecting the spinal cord has first priority. When you are at a location where emergency services can be expected within a reasonable timeframe it is best to limit your actions to providing that protection and to continue monitoring the level of consciousness.

Describe how to turn a patient as a unit.

If it is necessary to turn a patient, you should do it in a way that puts only minimal strain on the spinal cord. To do that, the entire spinal cord should stay in one line while turning. The requirement to keep the spinal cord in line excludes any technique in which you pull or push at one or two locations without stabilizing the spinal cord. Any force on a limited number of locations will cause that part of the body to move before the rest, resulting in strain on the spinal cord.

To turn the patient as a unit, kneel on the side toward which the patient is to turn. Take the arm closest to you and position it around the head. Place the other arm (hand with the palm up) under the body. Firmly take hold of the neck of the patient with one hand. With the other hand you to hold of the arm that was positioned under the patient's body at the elbow (an alternate technique allows holding the arm of the patient at the height of the hips). To have more force and to prevent strain on your own spinal cord, position yourself at a slight angle.

You now push the patient's arm against his back while at the same time rolling the patient toward you. Use your other hand to guide the neck. You should turn the head and neck in synchronisation with the speed of turning the rest of the body. Once the patient is lying on their back, put the arms and head in a comfortable position and continue to assist.

Describe how to put a patient in the recovery position.

If a patient is unable to remove fluids from the mouth and bronchi, or if you have to leave the patient alone to attend to other tasks, you can place the patient in a position that drains the mouth and assures an open airway. This is called the recovery position. The technique for putting a patient into the recovery position starts with the patient lying on their back.

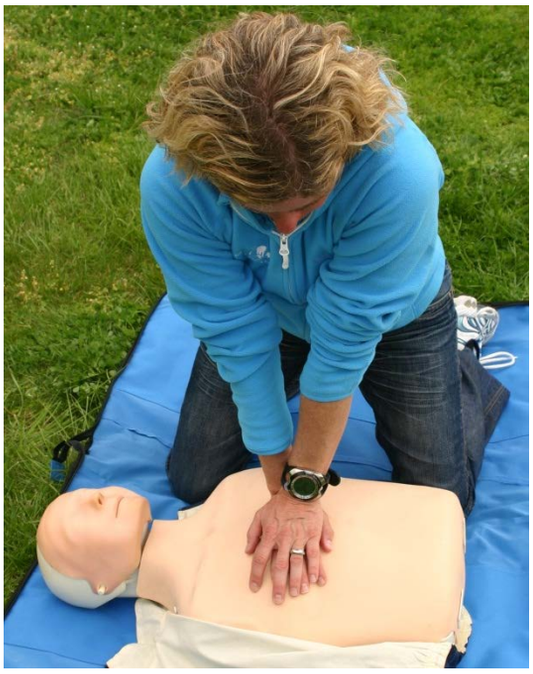
Place the foot of the leg furthest away from you under the knee of the leg closest to you. If necessary hold the bent leg in position. Stretch out the patient's arm closest to you. With the back of the other hand facing upwards, put is under the head of the patient. Now take hold of the elbow of that hand as well as the knee of the bent leg. Both can now be used as levers to pull the patient toward you. Do not

kneel too close to the patient. Once the patient stabilizes in the recovery position, you can reposition the head. Place the head so that it is supported by the hand and that and insure that the airway is open.

Describe possible actions when you find no signs of breathing during the primary assessment.

If you cannot detect breathing, the first step is to reposition the patient's head to assure an open airway. If still no breathing can be detected, you begin rescue breaths. Inhale before placing your mouth over the patient's mouth. Pinch the patient's nose. Exhale into the patient's mouth while observing the chest. Your exhalation should last about a second and should result in raising the patient's chest. Look away to inhale (to prevent inhaling air exhaled by the patient) and exhale into the patients mouth again. It is rare to have to provide only rescue breathing (without chest compressions), but if you do, first administer two breaths without pause and then one breath every five seconds.

If your first breath does not go in, reposition the head and try a second breath. If the air will still not go in, the airway is obstructed. To release the obstruction, deliver 5 back blows and then perform chest compressions such as for CPR, which may aid in liberating the respiratory passages. Continue the sequence until the obstruction is removed. Another technique is the Heimlich method, but that comes with the risk of internal injury. For that reason the Heimlich method is not allowed in some countries. If the Heimlich method is allowed, use it as a second option to remove the obstruction. After having delivered 5 back blows, straddle the patient's legs and place a fist just above the navel. Place the other hand on top. In a fast movement you push down (enough to be a little lower than the patients rib cage) and upward. The move compresses the lungs which results in a burst of air through the air passages. The Heimlich method on a conscious person is performed in the same way, but with the rescuer standing behind the patient.



It is unlikely that a non-breathing patient has circulation. A non-breathing patient is thus likely to need cardio pulmonary resuscitation (CPR), rather than just rescue breaths. Unless you see clear signs of circulation – a natural skin colour, a pulse – you must assume cardiac arrest. CPR alternates between rescue breaths and chest compressions. You perform 30 chest compressions, then two breaths again followed by another 30 compressions and so on.

Describe how to perform CPR on an adult.

To perform CPR, kneel down beside the patient's chest. The patient should lay on their back on a hard surface. Move the patient's arm closest to you out of the way and get so close to the patient that your knees are touching. From your position you should be able to alternate between chest compressions and rescue breaths. To perform compressions place one hand on the patient's chest (the part of your hand where the palm meets the wrist). Your hand should be located at the height of the nipples. In the practical part of the course you will learn how to find the correct location. Place the other hand on top of the first.

To perform compressions move your hips forward until your shoulders are exactly above your positioned hands. Keep your arms stretched all the time. Use your body weight to depress the chest 4 to 5 centimetres for every compression. Move up to prepare for a new compression by using your back muscles. You can also perform compressions by using your shoulder muscles, but that will cause you to tire sooner. The compressions should be performed at a rate of 100 compressions per minute. A cycle of 30 compressions should thus take 18 seconds. After every cycle the compressions are interrupted to open the airway and to give two rescue breaths.

List three reasons to stop performing CPR.

The first reason to stop CPR is because you cannot continue. Your ability to perform CPR is limited by your strength and physical condition. You can do as much as you can, but no more than that. If there is somebody who can take over, he or she should. If there is no-one else, there is nothing more you can do. Remember that a person needing CPR has already died. CPR does not safe lives. You cannot safe what is not there anymore. The only thing CPR does is to provide a chance for a new start. Unfortunately such a new start is only available for very few – even if CPR was started immediately and was done effectively.

CPR is unlikely to trigger the heart to start pumping again. A defibrillator is meant to improve that chance. A second reason to stop performing CPR is when an AED (Automated External Defibrillator) becomes available. Follow the instructions on the AED. This is likely to include switching the power on and attaching the patches. From that point on, the AED will lead you through all the steps, including prompting you to do one or more cycles of CPR. The third reason to stop CPR is the arrival of the emergency medical services.

Describe how to stop major bleeding.

If too much blood is lost, the distribution of oxygen can be endangered. Checking for major bleeding is thus part of primary assess-

ment, but does not take priority over breathing and circulation. However, if bleeding is too massive, it may be necessary to at least limit the bleeding before CPR makes sense. The general rule is to start taking care of major bleeding when respiration and circulation are found to be functional. If the bleeding is arterial, bright red blood will be spurting out of the wound. Arterial bleeding can be more difficult to stop than venous bleeding. If blood originates from a vein, it will be darker in colour and rather flow than spurt. Do not forget to check for blood under the patient. When blood is found, it may be necessary to remove clothing in order to get access to the wound.

The first step in controlling bleeding is direct pressure on the wound. Preferably exert the pressure with a bandage or clean cloth. Initially you hold the bandage in place while applying pressure. If you succeed in stopping the bleeding with this technique, you can choose between continuing to apply pressure yourself or to make a pressure bandage. If the blood is not clotting, you need to reduce the blood pressure leading to the wound. A slight reduction can be achieved by holding the wound higher than the rest of the body, but that might not be enough.

If the wound is on an arm or leg, you can reduce the flow of blood with a pressure point. Find a location where a major artery lies over a bone. It must be a location on the same limb as the wound and located between the wound and the heart. To reduce the flow of blood, you push the artery against the underlying bone. Pressure points are effective, but not without risk. Apply pressure only as long as needed. Continue with direct pressure on the wound while using a pressure point. Release the pressure point every few minutes to see if bleeding is reduced or has stopped.

Describe what can be done to prevent shock.

Circulatory shock is a life threatening condition. Once shock begins it tends to make itself worse. This makes it important to prevent the onset of shock. Assuring breathing and circulation as well as stopping bleeding are already actions that help to prevent shock. Since shock is related to inadequate oxygen levels in body tissues, all actions that support circulation aid in prevention. In addition, a rescuer may consider placing the feet of the patient 15 to 30 centimetres higher than the rest of the body. This will help the blood to flow back to the upper part of the body where it is most needed. Placing the feet higher should only be done if that action does not aggravate other injuries (for example if spinal injury is suspected).

Assisting the patient to maintain a normal body temperature also helps. Provide shadow in warm weather and additional insulation in cold weather. To prevent there being an inadequate supply to body tissues, it may also be of help to let the patient breathe emergency oxygen. As learned in the Oxygen First Aid course, emergency oxygen is recommended in a range of diving related emergencies. It is thus likely that emergency oxygen is available at the dive site.

Most equipment for emergency oxygen is easy to use. When using equipment with a first and second stage (connected via an intermediate pressure hose), it suffices to open the cylinder and to place the

mask on the patient's face. Equipment with a facemask that is connected to a regulator via a thin hose requires some training before using it. Since many divers have completed Oxygen First Aid courses, it is likely that one or more divers on the scene can operate the equipment. If the patient you are helping has just been diving, providing oxygen should be considered a standard procedure.

Describe when to do a secondary assessment and which assessment is to be used.

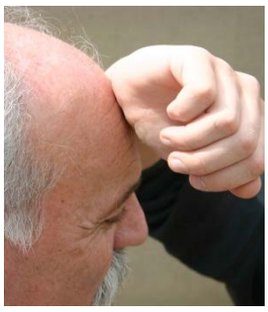
A secondary assessment deals with medical problems that do not interfere (directly) with oxygen distribution. Secondary assessment in only initiated after the primary assessment has not revealed any problems with oxygen distribution, or if any problems found were dealt with (such as stopping bleeding from a serious wound). If a secondary assessment is done as a continuation of primary assessment (in which case emergency medical services have already been notified) it is intended to provide maximum care for the patient.

In many cases a secondary assessment is done without a need for a primary assessment. The patient is alert and oriented, but does seem to have or claims to have a medical problem. In such cases the main goal of the secondary assessment is to establish if emergency medical services are needed. In other words, secondary assessment is used to establish whether the patient is able to go to visit a doctor, or if medical aid needs to come to the patient (or if no help is needed at all). Injuries are medical problems that are caused by impact from outside. Illnesses are conditions that develop within the patient's body. An assessment differs depending on whether you are dealing with an injury or illness. Hence, there are different procedures for a secondary assessment – one for injury and one for illness.

Describe how a secondary assessment is performed for an ill person.

The assessment of an unwell diver takes signs and symptoms into account. A sign is something that you as a rescuer can see, feel or hear. A symptom is something the patient says. The assessment of symptoms requires you to talk with the patient. Ask how the patient is feeling and if anything is different from normal. Ask about any existing medical condition (such as diabetes or problems with blood pressure) and previous medical problems. Ask about medication the patient is taking. You are also interested if the patient has recently eaten (and what), and if the patient is well hydrated. Depending on the situation, you may also want to ask about consumption of alcohol or recreational drugs.






The assessment of signs starts with a general appreciation of how the patient looks (normal, tired, sweaty, flushed) and then progresses to a comparative measurement of 4 specific signs. Comparative means that you compare the patients signs with your own, or those of another person. The specific signs are respiration, pulse, skin colour and temperature. Considering that you (or the other person to who you compare) feel healthy, the signs of the patient should be expected to fall in the same approxi-

mate range. Signs alone do not tell a lot. They must be backed up by symptoms. Somebody who just arrived at the finish of a 5 kilometre run will have a racing pulse, fast respiration, a flushed skin colour, as well as a warm and sweaty skin. That does however not mean that the person is ill.

Respiration and circulation are measured for speed. You need to know how often the patient exhales and what the heartbeat is per minute. To measure respiration you can hold the back of your hand close to the patient's mouth, or place a hand on the chest. You should be able to feel the breaths. You do not have to measure for a full minute. If you count the breaths for 30 seconds, you can multiply by two to calculate the number of breaths per minute. To find a pulse, place three fingers on the patient's wrist (on the side of the thumb). You might need to reposition slightly until feeling pulses that are strong enough to count. Also here, counting a full minute is not needed. Do not use your thumb to measure the patients pulse, as the thumb has a pulse of its own. People cannot influence their heartbeat, but they can change their breathing pattern. It is best to check respiration without the patient knowing it. You can camouflage your measurement by pretending to do something else, such as taking the pulse.

A good reference for skin colour is the inside of the lower lip. That measurement is independent of race or suntan. To measure the patients temperature, you place the back of your hand against the patients forehead and then against yours. Alternate between your forehead and the patients until you are sure if there is a substantial difference in temperature. Your assessment of signs and symptoms will most probably not lead to providing help. In most cases the assessment results in one of three possible decisions only. This can be contacting emergency medical services, contacting a medical doctor for advice, or not contacting medical professionals at this point.

Describe how a secondary assessment is performed for an injured person.

If a patient was not yet moved as part of primary assessment, an assessment for injuries should be done in the position in which the patient was found. In an injury assessment the skeletal structure of the patient is verified. The patient is also checked for neurological damage. Start by asking the patient not to move the head (if possible, you can support the head in position). Ask the patient to follow your finger with the eyes and how many fingers you are holding up. Check the neck and then the skull for deformity of weakness. Interrupt the assessment when the patient complains of pain when you are touching him or her.

After checking the head and neck, you palpate the collarbones and arms. For the collarbones you put a finger above and below and slide along the bone. Hold the arms at the shoulder and slide down the arm with the other hand. Pay extra attention to the elbow and wrist. Palpating is done with enough force to feel the bone structure of the patient, but not so forceful that you hurt the patient. Now ask the patient to move the hand and fingers. The spinal cord and shoulder blades are next. Move along the spinal cord and ask the patient to report any pain. Then put your hand under the shoulder blades and lift them slightly.

Feel the patient's abdomen. An internal bleeding would make the abdomen feel much harder than normal. Next push the patient's pelvis inward (from the sides). To check the legs, hold one leg at the hip and slide the other hand down along the front of the leg (the back of the leg has too much muscle to allow feeling the bone). Repeat this on the other leg. Pay extra attention to the knee and ankle. Then ask the patient to move the feet and toes and to push your hand with the feet.

During your assessment for injury you pay attention to any damage to the skin. Small wounds or abrasions can be taken care of after finishing the assessment. If your injury assessment reveals a bigger injury to the skeletal structure, internal bleeding or neurological damage, the emergency medical services must be notified upon arrival. Do not splint broken arms or legs unless you have to transport the patient (which is unlikely). Stabilise the broken bone in position instead. A rescuer should know how to splint a broken bone, but should only do so if transporting the patient before the arrival of the emergency medical services cannot be prevented.

Describe why a rescuer should know how to bandage minor wounds.

Not all wounds require the attention of medical professionals. As a rescuer, you can take care of minor wounds yourself with help of the contents of a first aid kit. Before placing a bandage, the wound should be cleaned. Running water is sufficient to clean most wounds. You can wash the area around the wound with soap (not the wound itself). Use sterile tweezers to remove any fibres or other bits and pieces from the wound. If an appropriate product is available in your first aid kit, you may disinfect the area around the wound.

Any bandage material used directly on a wound should be sterile. Take the bandage from the package after cleaning your hands (or after having put on gloves) and avoid touching the part of the bandage that will be put on the wound. Bandages should be applied firmly, but not so tight as to limit circulation. Secure the bandage with tape.

Describe the care for a diver (or swimmer) who has gotten in contact with nematocysts.

Divers are bound to get in contact with jellyfish tentacles. Jellyfish have nematocysts which are used to sting their prey. Contact with a jellyfish can trigger millions of nematocyst to pierce the skin and inject venom. Although the venom can be dangerous, most cases do not require the attention of a medical professional. Box jellyfish such as the irukandji jellyfish in Australia are infamous exceptions. Nematocysts that remain in the tentacles of the jellyfish did not all fire, and those that didn't still can. This makes personal protection for the rescuer and deactivation of remaining nematocysts a first priority.

The rescuer should put on gloves before starting to clean the wound. The water used for cleaning should be the same water in which the jellyfish lives. When tentacles of a jellyfish living in salt water get in contact with fresh water, the nematocysts may release venom. While rinsing, remove any remaining jelly or tentacles. A knife or the side of a credit card can be used to scrape them off. As an alternative to salt water, vinegar may be used to deactivate the nematocysts. Vinegar however should not be used when the stings originate from the Portuguese Man o' War. This is not actually a jellyfish and it fires its nematocysts when in contact with vinegar. After first aid is completed, an antihistamine ointment may reduce the discomfort.

Rescues and Assists

In this chapter you learn techniques to help other divers in the water. Such techniques are either an "assist" or a "rescue". The difference lies in the abilities of the diver receiving help. As long as that diver is able to perform actions that aid in a positive outcome of the situation, we speak of an assist. In contrast, a rescue means that you as the helper have to take complete control of the situation. The goals of rescues and assists are similar. Get the diver to the surface and out of the water – either to prevent a need for first aid or to make it possible to provide first aid.

Since every emergency is unique, a "dogmatic" approach is not possible. There are always different possibilities to address the same situation. As a Scuba Safety & First Aid trained diver, you should learn different techniques to address the same situation. The "arsenal" of techniques then allows you adapt to the context of a real emergency. Such context can relate to the equipment configuration of a diver, to water movement, to body size (yourself in relation to the victim) and many other factors. Learning rescues and assists involves experimenting with different techniques to get to know the possibilities and limitations of each.

Explain the difference between an assist and a rescue.

Before effective first aid is possible, an ill or injured diver has to be brought out of the water. Depending on the condition of the diver, the actions taken to bring the diver out are either called an assist or a rescue. Assists assume that the other diver can still fulfil tasks, but is unable to cope alone. A rescue assumes that the other diver is unable of any action that could aid in a positive outcome of the situation. Rescues are done for panicked divers, or divers who have lost consciousness.

Receiving assistance can be perceived to be embarrassing. Accepting assistance often feels like admitting incompetence. Rendering assistance thus requires the helper to provide the needed help while at the same time avoiding feelings of embarrassment. Often this can be done by addressing the assist as a mutual effort. Rather than one person helping another out of a problematic situation, the diver and helper join forces. Such considerations do not apply to rescues. In a rescue you take full control of the situation.

Describe how to assist a tired diver at the surface.

If a diver is too tired to make it back to the boat or shore, assistance is required. Remember that a tired diver can become a panicked diver. Assure ample buoyancy by inflating the BCD or ditching weights. Allow the diver to lie on the back. Breathing may be more comfortable when regulator and mask are removed, but if there is too much water movement, that might not be an option. Speak with the diver and provide assurance. If possible, ask the diver to swim while you tow.

Towing a diver can be done in several ways. An easy method is to simply take hold of the cylinder valve and tow. If you prefer to maintain eye contact with the diver (which is appropriate when you fear the diver could lose consciousness), place his legs on your shoulders. In that position you can either push the diver, or pull. Another option would be to take the divers scuba unit and weight belt. Without the equipment, swimming is a lot easier. If the diver is not too tired, this could allow the diver to reach the exit without being towed.

If you are not with the tired diver, but respond from a boat or the shore, you need to decide to enter the water or not. You could throw a line or a floatation device to the diver, or you could get in the water to personally assist. Throwing a line requires some practice. Make it a habit to aim at a point behind the diver. If possible, attach a floating object at the end of the line. The object should not be so big or heavy that it could hurt the diver.

If you enter the water from shore, your response is quicker if you minimize the swimming distance. While keeping visual contact with the diver (to know the location in case he does not succeed in staying at the surface), you walk to the point that is closest to the diver. Then you enter the water and swim. When responding to a diver in the water, always take mask, snorkel and fins. Fins will make you faster and more forceful when assisting. The mask and snorkel may be needed to locate the diver underwater.

Describe how to exit the water with a tired diver.

To facilitate an exit for a tired diver, it is often enough to remove the scuba unit and weight belt. In most cases, the diver will be able to exit without or with only limited help if the gear is removed. Should an exit without gear not be an option, then additional assistance is required. To climb the ladder of a boat, a rope around the chest will allow additional assistance. Exiting at a beach can be done by crawling out.

Describe the assistance for a conscious diver underwater.

There are several reasons why a diver might need assistance underwater. The diver can have a cramp, be overexerted or have run out of air. The diver can also have equipment related problems such as a frozen second stage or a cylinder that has slipped out of the BCD. In most (but not all) cases, an assist is aimed at bringing the diver to the surface in a safe and controlled manner. If the assist can be completely carried out underwater, the dive could continue. After releasing a cramp or securing the divers cylinder in the BCD, there is normally no reason to abort the dive.

When assisting a diver underwater, you should avoid grabbing the diver from behind. Approach the diver from where you can be seen and signal what you are going to do. If the diver is out of breath, you can aid in restoring a normal breathing pattern by making the diver stop all activity. Hold on to the diver. Consider signalling with your hand when to inhale and exhale. The approach for helping with cramp release is similar. Communicate with the diver in order to find the exact location of the cramped muscle. Then massage the affected spot while alternating between stretching and relaxing the muscle. You can stretch a leg muscle by pushing on the fin.

A diver who is out of air will normally give the appropriate hand signal(s) and then take the initiative to get your alternate air source. This skill is learned and practiced in beginner courses. Sometimes a diver does not react as learned (and expected). Some people freeze when a problem occurs. This means that it might be necessary for the donor to take the initiative. If a diver is out of air you can take control by clearly presenting your alternate air source. Firmly grab hold of the diver (for example at the straps of the BCD) and assure that the diver takes your alternate air source in the mouth. Then guide the diver toward a normal breathing pattern before starting the ascent.

Describe how to rescue a panicked diver.

If a diver gets into panic underwater, the most you can do is to control the ascent as well as possible. Panicked divers use all their force to get to the surface. It is likely that you cannot react before they are on their way. If you can, it is most likely that you can only slow down the ascent somewhat. Do not put yourself in danger. If you cannot stop the diver, just let go. Follow the diver by ascending at a normal speed while keeping eye contact with the panicked diver (if visibility allows). Do not surface too close to the diver. A diver in panic has lost all rational thinking. If you get too close, the diver will grab you, which puts both of you in danger.

At the surface, try talking to the panicked diver. Instruct the diver to dump weights or to inflate the BCD. Keep several metres distance between you and the diver. If you notice that the diver is moving toward you, you should make use of that. Maintain a constant distance between yourself and the panicked diver while moving in the direction of safety (the boat or shore). As long as the diver follows you, there is no need for any other action.

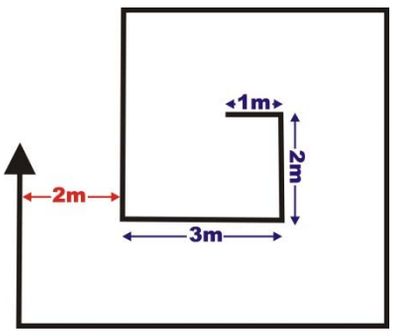
If the diver does not follow you, or if there is no safe location available, you must establish positive buoyancy. The easiest way to approach a panicked diver is from below. Go underwater and swim under the diver. With stretched arms (out of reach of the diver's arms) release the diver's weights. To inflate the BCD you can come up behind the diver. Grab the cylinder valve with your hand with your arm completely stretched. Now take the upper part of the diver's cylinder between your knees. The higher you are with your knees and to the greater extent your arm is stretched, the less the risk is that the diver can grab you. Now reach over the divers left shoulder to get hold of the inflator in order to inflate the BCD. If the diver has a pneumatic inflator system, you should inflate while being underwater in the same position as you were for ditching weights. After you have established sufficient positive buoyancy, keep your distance and wait for the diver to calm down.

If you cannot go underwater, you must find a way to get behind the panicked diver at the surface. A second diver can try to distract the victim. As a matter of last resort, you can turn the diver. To do this, you grab the divers opposite arm and then forcefully pull to turn. The moment you are facing the back of the diver you should take hold of the cylinder valve and take the upper part of the cylinder between your knees. The rest of the procedure is the same as for the approach from underwater. If the victim manages to get hold of you, you can escape by going underwater.

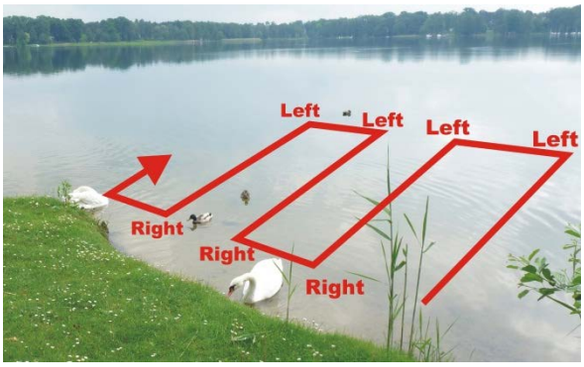
Describe techniques to find a missing diver.

A search for a missing diver should not take longer than needed. This calls for a systematic approach. Search patterns allow a rescuer to avoid overlap in the search and reduce the risk of missing part of the area. Ideally the search starts at the location where the diver was last seen. From that point the search expands in all directions. Consider starting with a rough search. Use a search pattern, but with bigger distance between the passages than you would have for a more thorough search. This gives you a good chance of finding the diver, while at the same time getting an overview of the site. If the rough search was unsuccessful a more detailed search is started. During the rough search divers should watch for any ascending bubbles.

If there is no (or only little) current, you can make use of a compass. There are two useful patterns with a compass. These are U-patterns and an expanding square. The expanding square is used when you are further away from shore. U-patterns are more suitable for when you have a reference at one side of the search area, such as the shore. Current and bottom composition are the most important factors for the choice of a search pattern. Another factor is the number of divers available for the search. If there are 20 divers present, you would not use the expanding square, because you could only efficiently use two divers. In that case U-patterns would be more appropriate, since you can assign each team of divers a different section of the search area.



Once you have selected a search pattern, the next step is to decide how accurate the search is going to be. You can adapt every search pattern to the visibility at the dive site. Each length of the search can be 50cm apart or 5 meters – this does not change the pattern, only the accuracy. For the expanding square, you make 90° turns in the same direction after every length. Each length is one unit longer than the previous one. Count kick cycles while swimming and always add the same number for the next length. If the visibility allows you to have the lengths 4 kick cycles apart, you start with 2, then 4, then 6, etc. If you need an accuracy of 2 kick cycles, you start with 1, then 2, then 3, etc.

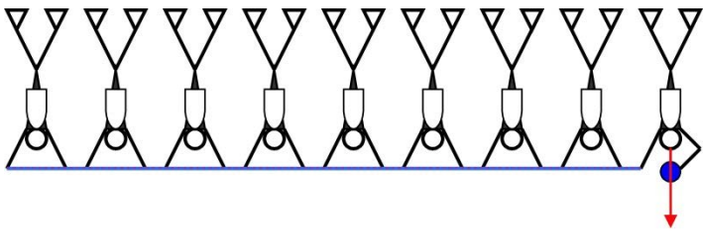


For a U-pattern you have two options. If you are doing an accurate search, you start to swim at a 90° angle from your reference line, which can be a weighted line, the coast, a jetty or any other underwater structure. When completing a length, which can be measured by reaching another line, a distance in kick cycles or reaching a specified depth, you move to the side and swim back in the reciprocal compass bearing. You repeat this procedure each time you arrive at the other side. If the distance between the lengths is considerable, you can also use the compass for the sideward lengths. In that case the pattern is plus 90°, plus 90°, minus 90°, minus 90°, plus 90°, etc.

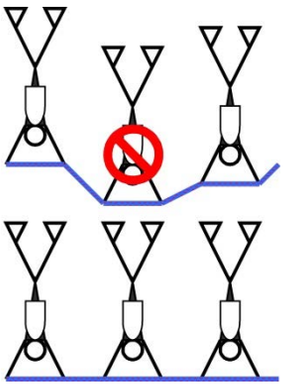
Close to shore you might not even need a compass to swim a U-pattern. Sand ripples will allow you to swim in a straight line using natural navigation. Although the shore line is a good reference point for U-patterns, you might want to consider swimming the long lengths along the shore line and not toward and away from the shore. Swimming along the shore line allows you to prevent the repeated ascents and descents. If you are swimming to and away from the shore your ears are affected by repeated depth changes.

If available, a weighted line is very useful for searches. The line is placed on the bottom and used for reference. The procedure is as follows. Two divers each hold one end of the line. They pull the line straight and place it on the bottom, giving a pull to indicate to the buddy that the line is in the correct position. Now both divers start to search the area to the right side of the line (as they swim in opposite directions, the search is done at both sides of the line). Arriving at the other end, both divers take up the line and place it (depending on the visibility) 1 or several meters to the side, give a pull again, and again search the area to the right side of the line.

This procedure with a weighted line allows for a very accurate search of a small to medium sized area. It is mostly used to relocate small objects, but can also be useful for finding a missing diver. If you don't have weighted line available, you can also use "normal" line with a weight at each end.



Some more experienced teams for searches can use a line to guide a group of divers. One diver uses a compass to keep control over direction and the others maintain their position on the line by paying attention to the position of the line in their hands and adapting their depth and speed to the rest of the team. Normally several training runs need to be done before a team can use this method efficiently, but when it works it permits searches of a large area in a relatively short time. The idea is to use the line as an indication for your position, but not pulling the line in any direction. If one diver in the team pulls on the line, the entire team will swim in the wrong direction.



Each diver should pay attention that the rope left and right from his hands is exactly in line with the piece of rope between his hands. When it is not, he should not pull the rope into position, but swim to bring himself into position. It requires some training, but it is a challenging and fun group effort.

A traditional search pattern with a line is the circular pattern. It is useful on a flat bottom and will still work with in a relatively strong current. The anchor in the middle is normally a diver and the line is used both for navigating the search pattern and for communication. The diver who is swimming the search pattern must make sure that the line is continuously under tension. The diver also has to know when a circle is completed. The diver in the middle must make sure that he always stays at exactly the same location.

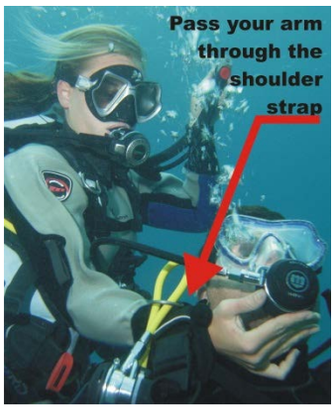
In order to avoid drag while swimming, the line used should be thin. If a diver is in the middle, it is that diver who is holding the reel. The diver navigating the circle swims out until the line is under tension, sticks a pin or another marker in the bottom and starts swimming the circle. When getting back to the pin, he knows that the circle is completed and pulls twice on the line to communicate to "the anchor" that he needs more line. The anchor rolls out more line from the reel (how much is depending on visibility). The diver navigating swims out until the line is under tension, sticks the pin in the bottom and starts the next circle. This way the search is expanded as long as needed.

Describe techniques to bring an unconscious diver to the surface.

If a diver is found the first step is to establish whether or not the diver is conscious. A non-responsive diver must be brought to the surface. If the diver still has the regulator in his or her mouth, it should be kept in place. If the regulator is not in the mouth, it is your choice as to whether you want to put in back in place or not. However, you should not waste time in doing so because the regulator will probably not do any good. Ascending with an unconscious diver requires some planning for hand positioning. You must firmly hold the diver, keep the regulator of the victim in his or her mouth, keep the head of the victim in a position that assures an open airway, and have a hand available to make buoyancy adjustments.

Taking the victim's cylinder between your knees liberates both hands. This technique allows you to hold the regulator (and the head position) with one hand while adjusting buoyancy with the other. You can adjust the buoyancy for yourself and the victim with a single BCD. The choice is, "which one?" Considering that you might lose contact with the victim, it might be good to adjust buoyancy with the victims BCD. If you lose contact, the victim will have positive buoyancy and continue floating toward the surface if you have to let go.

In another technique you make use of the BCD. Pass your hand through the shoulder strap of the BCD, and use that same hand to position the victim's head and to hold the regulator in place. That single hand is now used for all functions with the exception of adjusting buoyancy. If the BCD is equipped with a chest strap, a similar technique can be used by passing your hand under the chest strap. There are several other techniques. You can use your elbows and arms to hold the diver against your body while using your hands to adjust buoyancy and head position. It is also possible to pass your arm under the victims arm or to place your legs around his body. In order to be prepared to handle emergencies, you should try out the different techniques. Trying is the only way to find out about the advantages and inconveniences of each technique.



Describe the considerations for handling a non-breathing diver at the surface.

In the water effective first aid is not possible. If a diver is unconscious (with or without respiratory arrest), the first priority is to get the diver to the shore or boat. If you are close to an exit and can remove the diver's equipment and bring him out of the water in a few minutes, then that is what you should do. If you anticipate the transport and exit to take longer, you should start artificial respiration in the water. This should be done in such a manner that no time is wasted. Artificial respiration is done during equipment removal and transport.

When you see a diver floating at the surface, you approach while keeping eye contact. If the diver sinks, you want to be informed of his location. If the diver lies on the back, continue the approach until you reach the diver. If the diver has a face down position, stop out of reach of the diver. Splash water and shout to see if the diver reacts. If the diver is just laying at the surface to observe a whale shark, he might not appreciate a "rescue". If there is no reaction, you do the final approach and turn the diver on his back. To turn the diver you can take hold of the cylinder valve and pull it down. If the victim has no scuba gear on, go to the side of the head. Grab the victims wrists with your opposite hands (your arms are crossed) and then pull outward. This action will turn the victim.

Your next actions are, insuring positive buoyancy, calling for help, and removing the victims mask and regulator. Dump weights and/or inflate the BCD. If divers are near you can signal for help using a hand signal. If you want to draw the attention of non-divers it might be better to yell and wave. Your hope is that somebody on shore (or the boat) already has called the emergency medical services and that they stay around for helping to bring the diver out of the water. Now check to see if the patient is breathing. Place your ear as close as possible to the diver's mouth (if you are wearing a hood, it should be removed), observe the diver's chest and if possible place a hand under the Velcro waist strap. Check for breathing for about 10 seconds. If no breathing is detected, start artificial respiration. First give two rescue breaths and then one every 5 seconds. If you need to interrupt for more than 5 seconds, start a new cycle by beginning with two rescue breaths again.

For rescue breaths you can chose between mouth-to-mouth, mouth-to-nose and mouth-to-mask. The word "mask" in that last option revers to a Pocket Mask. Pocket Masks are useful in calm water and protect the rescuer against infection risks. They are however not always available (some divers always have one in their BCD pocket) and are hard to use in adverse surface conditions. Mouth-to-mouth works well, but requires the diver to come high out of the water, close the patients nose while giving rescue breaths and to support the head of the patient. This requires the rescuer to interrupt the removal of equipment every 5 seconds. Rescuers with relatively long arms can close the patient's mouth with the hand from the arm that reaches around the head. That same arm then supports the patients head. This allows mouth-to-nose breathing while having one hand free to remove equipment without interruption.

Whether the rescuer ditches weights or not depends on the thickness of the suit. Thick suites make it difficult to move at the surface without weights. The flotation of the suit makes it difficult to maintain a vertical position when removing equipment, and to keep the fins underwater when swimming. With thinner suits ditching weights has no disadvantages. Similar considerations apply to equipment removal. In some cases you benefit from the additional freedom of movement which results from ditching your own equipment first. In other cases you might give priority to the additional flotation provided by your BCD and only ditch your equipment at the last moment. The only way to get a feeling for the appropriate solution in a given situation is to experiment in a variation of circumstances.

Describe techniques that can be useful for ditching equipment.

To improve hydrodynamics and to make it easier to exit with a non-responsive diver, equipment should be removed. The rescuer should hold onto the mask and snorkel for unexpected circumstances and needs fins for transporting the victim. Pull the mask down around the neck (and maybe turn it to the back of the neck so as not be in the way) rather than pulling the mask from the head. Since the victim is unresponsive, it does not matter if his mask gets lost.

The victim's weights are most probably already ditched as part of the initial response. If not, then they should be ditched before removing the scuba unit. The best technique to remove the scuba unit depends on the equipment configuration and circumstances. Start the removal of the scuba unit by identifying (and removing) all accessories that could entangle with BCD straps or regulator hoses. Some divers carry many gadgets with them and most of these will be attached to the BCD with clips or lanyards. Look for surface marker buoys, a camera, torches, slates and other items. While you are at it, also observe the BCD straps and buckles to decide how to best remove the scuba unit.

Start removing a BCD by opening the buckles of chest and waist straps. After that you open the Velcro strap (present on most BCDs). Velcro straps tend to close again after you let them go. To prevent this from happening, you place the end that was on top under the other end. You can also stick the end that was on top between the body of the diver and the BCD. You actions so far have released the BCD from the front of the diver's body. The next step would be to remove one or both arms. Techniques to free the arms vary. Many BCDs have clips on the shoulder straps that could be opened, but not all. You should also keep in mind that clips on shoulder straps can hardly be opened with (very) cold fingers. If shoulder straps are present and can be opened, use them. Once you have done that you can simply deflate the BCD or push it from under the diver to remove it.

Also your own BCD can be removed by opening the chest and waist strap buckle, opening the Velcro band and then opening a shoulder strap. If there is no buckle on the shoulder strap, if it is not accessible, or if you cannot operate it (because of cold fingers or another reason), you will need to use a different technique. Pulling your shoulder out of an inflated BCD is not an elegant solution. The inflated BCD can hardly be pushed underwater. You have to move higher in the water in order to get your shoulder out of the BCD. In most cases such attempts result in wild and badly coordinated movements. If you deflate your BCD before removing it, it will be a lot easier.

You can also remove an inflated BCD without the necessity of moving higher in the water. Simply slide your hand under the shoulder strap until the strap is at wrist level. Then extend your arm as you would do when shaking somebodies hand. The movement of stretching the elbow will remove your arm from the BCD. Do not pull with the arm. You do not need any force. Stretching of the elbow is the only movement needed. That same technique can be used for your victim. Place his hand under the shoulder strap of the BCD. Then take the hand and move it as if you wished to touch the victim's knee with that hand.

If you are in a hurry, you can grab the stretched arm of the victim with one hand and the shoulder strap of the BCD with the other. Push the arm and pull at the shoulder strap at the same moment. Continue pulling forcefully on the shoulder strap when the arm of the diver is already out. This will turn the diver and role him out of the scuba unit. The method works fast, but has the disadvantage that the face of the victim is momentarily emerged. Only use this technique if speed is of the essence.

Describe techniques to exit with an unconscious diver.

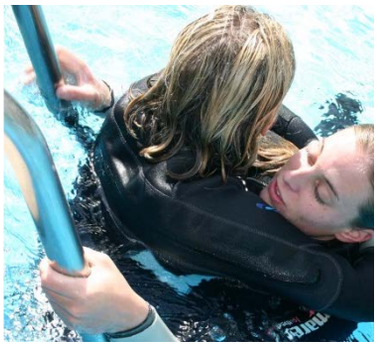
The more helpers there are, the easier it is to bring an unconscious diver out of the water. Do not hesitate to ask for help if other divers, swimmers or bystanders are present. Bringing a diver out of the water on your own is harder, but with the right technique it can be done. A proven technique is the fireman carry. The technique is especially suitable to bring somebody out of the water. In the water it is easy to bring the victim into position. Turn the diver on the side, put the arm of the diver over your shoulder to keep the head above water, and then grab the leg with your other arm. Now work your shoulders well under the diver and stand up. You can either hold the diver with one arm, or use both hands to keep the diver on your back.

If the diver is too heavy for you to carry, you can use the method invented by Franz Rautek. Bring the victim into a sitting position. Approach from behind, putting both your arms under his armpits. Both your hands then grab the same lower arm of the victim with all fingers and the thumbs being placed on top of that lower arm. This avoids injury to the ribs of the victim by the thumb of the rescuer. The victims arm should now be horizontal and pressed across his chest. You can now stand up and drag the victim while walking backwards onto the beach.

If you have to exit over a slippery surface, as is often the case on dikes or levees, you cannot risk standing up to carry or drag the victim. In such situations, you can crawl out. Sit behind the diver with his back against your chest. Pass your right arm under the divers arm and hold the chest. Position your right foot and left hand so that you can lift yourself and the diver. Move backward and sit down. Repeat the same movement until you are out of the water. With this technique you will not move more than a few decimetres at a time, but your position does allow you to interrupt moving backward to give rescue breaths. If you are left handed, the technique can also be done the other way around.

If the exit is too steep to walk or crawl out of the water, other techniques must be used. At the side of the pool or a low jetty, you can place a hand or arm of the victim on the deck and hold it while you exit yourself. Now take the arms of the diver and pull the diver up. If another diver is available, you can make use of the fact that neoprene on neoprene slides well. Let a diver place his forearm against the pool or jetty wall and place the head against it. Then place the victim against the divers back. The diver functions as a slide that makes it amazingly easy to pull the victim out of the water.

There are several other techniques. Many are adaptations of the above techniques, but altered to be more suitable for local circumstances. Other divers and especially scuba professionals can be a good source of information for techniques that are commonly used by local divers.

Managing a Diving Emergency

Every diving related emergency is unique. This makes it impossible to learn a “standard” approach to deal with such an event. Decisions taken in emergencies must take the context in which you are into account. Learning how to take such decisions can only be done by actually doing it. This part of your training toward a Scuba Safety & First Aid certification provides you with opportunities manage simulated emergencies. The content of this chapter is short, but that does not make it less important than the other chapters.

Explain why completion of the Scuba Safety & First Aid course alone is not sufficient preparation to act in case of an emergency.

Emergencies virtually always come unexpected. This puts high demands on rescuers. You must be ready to act with hardly any prior warning. Even if your skills and fitness allow you to react adequately in a variation of circumstances, your management of an emergency is likely to be insufficient if there is a lack of equipment and/or lack of local knowledge. Management goes beyond the skillset of the individual. Managing an emergency does not necessarily mean that you do a rescue in person. Management means that you organise available resources to maximise the chance of a positive outcome.

Managing available resources is only possible when you are aware of what is available and where to find it. This does not mean that you should pack your car full of items that could be of use when an emergency arises. It means that you are aware of the level of training of other divers who are present. It means that you know where to find first aid materials and emergency oxygen. You should also know the local emergency number and know how to identify the dive site in such a manner that responding staff can easily find you. This can include you assigning a rendezvous point close to the site, in the instance that the site itself is hard to find.

Describe how to improve preparedness to act in an emergency.

Do not let an emergency catch you by surprise. Accept the fact that an emergency is always possible and start planning how to deal with it the moment you arrive at a dive site. Ask yourself how you would describe the location when an emergency call is placed. Look for the easiest exit and most appropriate evacuation route. Make yourself familiar with the qualifications of other divers on the scene. Look for lines or ropes and flotation devices that can be used to assist a tired diver from the shore. Where the first aid and oxygen equipment are, and (if in a car) who has the keys.

Some of the information you require changes. The divers who are present are not always the same and useful equipment may be available one day, but not on another. Some information does not (or hardly ever) change. Such lasting information includes the description of the location or rendezvous point, the evacuation route or the best place to exit the water. An emergency plan is meant to preserve permanent information. Some divers make it a habit to write down relevant information for dive sites they frequently visit. The plan provides a basis for managing an emergency. It assures that key information is available to which information about the current situation can be added.

Describe why the ability to improvise is important for managing an emergency.

No matter how well you have prepared yourself – both by making an emergency plan and by assessing the situation on site – you are bound to be confronted with surprises. The car with the first aid kit has just left, or the diver with the certification in rescue and first aid is unreachable underwater. Planning to be ready for an emergency is not intended to have a rigid step-by-step protocol available. It is just meant to increase your awareness of possible options.

Improvising means that you find different ways to achieve your goal in the absence of the resources you have considered in your planning. Improvising also means applying solutions that were meant for a different situation to the situation with which you are confronted. When confronted with a challenge, you should find ways to overcome it. The better you are at overcoming (unexpected) challenges, the better you are in improvising.

Describe a possible sequence for the thinking process to formulate a plan to deal with an emergency.

When an emergency arises, your first thoughts should be aimed at formulating the desired outcome (the goal). As an example: you observe a diver surfacing in panic at a distance of about 30 meters from the shore where you are in the process of preparing your equipment.

Your desired outcome could then be to get the diver out of the water as soon as possible without putting other divers in danger. Another example: during a dive you lose contact with your buddy. After searching for about half a minute, you decide to ascend. At the surface you do not find your buddy, do not see bubbles indicating that a diver is close and after more than a minute of waiting there is still no sign of him. Your desired outcome would be to find your buddy as soon as possible, to deal with any problems he may have and if needed to get him medical attention without delay.

Your next thoughts address your environment. Questions guiding this step are: where am I, where is the most appropriate exit, which areas should I avoid (because of currents, waves or other reasons)? This provides you with a sequence of actions – first swim there, get around that, exit there, etc. While mentally following this sequence, as a next step you try to identify challenges. Where in this sequence of events do you expect difficulty? Questions guiding this step are: can I tow a diver for such a distance; is the diver not too big for me to carry out?

Now the time has come to improvise. Knowing your sequence of events as well as anticipating where challenges could be expected, you look at possible ways to overcome those challenges. If you are not sure if you can tow a diver for the required distance, can you shout for help to make others meet you halfway? If you cannot throw a line 30 meters far, is there a way to reach a tired diver in another manner (is there a surfboard lying around, are others closer to the tired diver than you)? This part of your thinking process is meant to take other people, equipment and tools on site into consideration. You have a sequence of events and have identified challenges. Imagination on how to best use people, equipment and tools can substantially increase chances that an emergency has a positive outcome.

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