

Robin Seiffert and Dominik Szymiski

64.1 Characteristics of the Sport

Scuba diving is a specific form of underwater diving (Fig. 64.1). In difference to apnea diving scuba divers, use a self-contained underwater breathing apparatus (scuba) to produce artificial air allowing the diver to dive over a long period of time. Therefore, they carry an own source of breathing gas, usually compressed air, but there are different

gas mixtures available. The biggest scuba diving company is the Professional Association of Diving Instructors (PADI) diving founded in the USA in 1966 with over 6000 diving places and 130,000 members in 183 countries. There are different kinds of sport diving including technical diving, ice diving, cave diving, or wrack diving. Specific knowledge and abilities and therefore education are needed to participate in these sports.

Fig. 64.1 Diver in the ocean (stockadobe.com—by Jukka)



R. Seiffert (✉) · D. Szymiski
Department of Trauma Surgery, University Medical
Centre Regensburg, Regensburg, Germany

64.2 Physiological and Biomechanical Demands on Athletes

While being underwater divers, enter an environment they are not made for and in which they cannot survive for a long time without technical support. There are not many other situations—especially in sports—where one is directly confronted with different physical conditions. Divers need to continuously control their and the equipment's limits. During the descent and ascent, divers need to make sure to balance the pressure to prevent barotraumas and decompression illness.

Most important risks:

- Not complying with regulations and one's own limits
- Decompression illness because of rising too fast
- Barotraumas due to physical pressure differences
- Uncontrolled behavior caused by a panic attack
- Loss of consciousness
- Hypothermia because of an insufficient diving suit
- Uncontrolled loss of air due to a damaged scuba

64.3 Epidemiology of Injuries

Statistically diving is a very secure sport. According to the long-term international statistics provided by Divers Alert Network (DAN), there are about 4.7 accidents per 1,000,000 dives every year around the world. In comparison, 4.9 per 1,000,000 swimmers died in Germany in 2014.

Nitrogen as one of the gases in the air and water can lead to rapture of the deep, which is a dangerous condition for the diver—especially for inexperienced ones. Its biological effects can change under pressure underwater. Similarly, oxygen can become toxic in high concentration and under high pressure and can lead to central nervous system symptoms.

Barotraumas can occur during the descent and surfacing and result in different symptoms. For instance, the diver can suffer a rupture of the eardrum or lung.

One of the most common and dangerous accidents that can occur is decompression illness. Inert gas components of the diver's breathing gas accumulate in the tissues during exposure to elevated pressure during a dive and must be eliminated during the ascent to avoid the formation of symptomatic bubbles in tissues where the concentration is too high for the gas to remain in solution. This process is called decompression. To avoid this formation, divers need to maintain safety stops while arising. Symptoms can differ from pruritus to loss of consciousness, paralysis, and death.

Divers can also be injured by jumping into the water or when underwater by animals or rocks or corals. Depending on the cause, wounds sometimes do not heal very well. A prolonged further treatment may then become necessary.

64.4 Specific Rehab and Return to Play

Patients with decompression illness need specific and professional medical treatment and should inhale pure oxygen as quickly as possible. If necessary, patients can be treated in a decompression chamber.

There is a field of medicine especially for diving sports called diving medicine, which deals with diving-associated health issues.

Barotraumas can sometimes heal on their own. Decongesting ear drops and analgesics can be helpful. If the injury is more serious, corticosteroids or even a surgical intervention may become necessary.

Healing wounds require some specific precautions. It is very important to give the wounds time to heal. Therefore, the tissue should not get too strained. Also, wounds should stay dry. Therefore, athletes with wounds should not go into the water or alternatively use protection wear.

64.5 Prevention Strategies

The safety of [underwater diving](#) depends on four factors: the environment, the equipment, behavior of the individual diver, and performance of the diving team. The underwater environment can impose severe physical and psychological stress on a diver and is mostly beyond the diver's control.

Every sort of diving has its own specifics and therefore its own dangers and potential risks. It is mandatory to absolve a solid diver's training to learn the theoretical and practical requirements concerning equipment, diving planning, and proper behavior underwater. Diving organizations offer different kinds of courses for each level of knowledge to learn or expand ones abilities. Divers have to adhere to the different limits, which all aim to prevent accidents while diving. The limits result from knowledge gained in diving medicine and physics.

Divers should always dive together to keep one another safe. Various hand signals can be used as a form of communication. Obviously, these signals also need to be learned because they are essential for survival especially in dangerous situations.

The most important strategy to prevent accidents is always to know one's own skills and limits and to not risk anything. Furthermore, allowing for safety stops during ascent is the most effective one for preventing decompression illness. Regular training not only on holiday is essential to prevent accidents.

64.6 Equipment and Protection Considerations

Besides the scuba with the breathing gas divers need various equipment. A scuba diver moves in the water with the help of various tools. Fins attached to the feet, a diver propulsion vehicle, or a sled pulled from the surface help the diver to move in the three-dimensional water. Moreover, a mask to improve underwater vision, exposure

protection, equipment to control buoyancy, and equipment for the specific local circumstances are needed. A snorkel can be used while swimming on the surface. In addition, tools for controlling the navigation are very important. Therefore, divers own a compass, a pressure gauge, an underwater watch, a depth gauge and a diving computer for calculating the position and a safe ascension. Moreover, divers can carry some other tools they might need like a knife or a whistle. In addition, one can use a board and a pen to draw a map of the diving spot. Overall, divers use many different tools, some of them are obligatory, others are optional—the choices depend on the diving spot and the experience of the diver (Fig. 64.2).

64.7 Other Health Aspects and Diseases

As the diving sport is growing and gaining in popularity, the environment is endangered by the mass of divers. Therefore, it is very important to educate divers about behavioral rules underwater towards marine diversity.

64.8 Fact Box

- Scuba diving is one of many diving types, includes different types of scuba diving (i.e., technical or cave diving).
- Use of self-contained underwater breathing apparatus (scuba) for breathing underwater.
- PADI is the biggest diving organization with 130,000 members in 183 countries.
- Most common injuries: barotraumas and decompression illness (4.7 accidents in 1 million dives).
- Safety of underwater diving depends on four factors (environment, equipment, individual behavior, team performance).
- Education and training are mandatory to participate.
- Different kind of equipment is used.



Fig. 64.2 Typical diving equipment (stockadobe.com—by krugli)

Recommended References

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2. Ellerman Ret CMDR RL (2018) Diver medical technician: care of the injured diver
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