

CASE REPORT

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Nitrogen Narcosis and Alcohol Consumption— A Scuba Diving Fatality

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ABSTRACT: Nitrogen narcosis can cause death among experienced scuba divers. Nitrogen under pressure affects the brain by acting as an anesthetic agent. Furthermore, the consumption of ethanol along with diving will cause the symptoms of nitrogen narcosis to occur at depths less than 30 m. Our case deals with an experienced diver who drank alcoholic beverages before diving and developed symptoms of nitrogen narcosis at a shallow depth. These two conditions contributed to his death by drowning.

KEYWORDS: pathology and biology, alcohol, diving, nitrogen narcosis

In the last few years as people have become more conscious of physical activity and fitness, Scuba diving has grown in popularity. Many clubs have been established with professional divers as instructors.

Scuba diving is a wonderful sport that encompasses exercise and adventure. Almost anyone may become a scuba diver as long as they have no circulatory or respiratory problems and are able to swim. It is a relatively safe sport; however, there are some hazards [1].

Correct training consists of numerous and thorough exercises which instruct the diver on what to do in every possible circumstance and emergency. Despite the intense training, accidents and deaths have sometimes been documented [2,3].

Our case deals with such an accident that led to the death of an experienced diver. Death by drowning was caused by alcohol consumption and nitrogen narcosis, better known as “rapture of the deep” [4]. The victim was a member of a semiprofessional diving team who broke one of the cardinal rules of diving by using alcohol before the dive.

Case Report

The victim was a 34-year-old tourist who spent a few weeks every year in Greece participating in underwater activities as a member of a semiprofessional diving team. According to his wife and teammates, the victim had some psychological problems for which he was undergo-

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ing psychoanalytical therapy, but no drugs were taken. He was an experienced diver of 12 years and familiar with Greek waters.

On the day of his last dive, his teammates saw him in his car drinking something from a bottle that was later discovered to contain alcohol. A few minutes later he dived with two fellow divers to a depth of approximately 15 m. They noticed that the victim became motionless for a period of 8 to 10 min. The victim did not respond to their signals to dive deeper and they realized that something was wrong. They swam to the victim to offer assistance, but their efforts were thwarted. He abruptly took off his mask and regulator, made strange movements, and lost consciousness. They interpreted his actions as typical for "rapture of the deep." However, the depth was not sufficient to produce inert gas narcosis by itself.

At autopsy, froth exuded from both nostrils and the mouth. No "goosefleshing" or skin maceration were evident and no injuries were seen. The trachea and both main bronchi also showed the presence of froth. The lungs were heavy and edematous; the lungs weighed 750 and 700 g right and left, respectively. Their cut surfaces exuded frothy fluid. Some dilatation of the right side of the heart was noted, and the stomach contained a small amount of water. The skull and intracranial contents failed to reveal any injuries. The myocardium, coronary arteries, liver, and other viscera were unremarkable.

Toxicological analysis of blood showed an ethanol concentration of 0.125%. No drugs or carbon monoxide were present in the blood.

Inspection of the gas tank proved that it was functioning properly. No notes were found in a search of his car.

Discussion

Nitrogen under normal conditions has no effect on the human body. According to Henry's law, a gas will dissolve in a liquid in accordance with the pressure exerted on it under standard temperature. With an increase in partial pressure, nitrogen will dissolve in greater quantities in the blood. Nitrogen under certain pressures acts as an anesthetic agent [5,6].

Nitrogen narcosis (usually in water deeper than 30 m) is related to the following factors: physical fitness of the diver, exhaustion, and alcohol or drug consumption [7]. Lightheadedness, dizziness, loss of judgment, anxiety, depression, and aggressive behavior are symptoms commonly associated with nitrogen narcosis [6].

In relating the findings in our case to the above factors, we conclude that death was due to the interaction of ethanol consumption and nitrogen narcosis and classified as accidental. Any other possible cause of death was excluded. The victim had no coronary lesions or evidence of a drug taken. There were no other injuries or pathological changes suggesting another cause of death. Hypothermia, a well-known cause of death [8,9] among swimmers, was excluded because the environmental temperature was about 35°C. The ethanol is believed to have acted as the trigger for the development of nitrogen narcosis at this shallow depth. Nitrogen narcosis is known to occur at depths of 30 m and greater and is unknown to occur at lesser depths.

Ethanol often causes mental confusion, emotional instability, and loss of critical judgment at blood alcohol concentrations between 0.10 to 0.14% [10]. In our case, the blood alcohol concentration was 0.125%, enough to cause emotional instability but not enough for a toxic condition that can cause death by drowning [11,12].

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