Lung Overexpansion Injuries in Diving

The symptoms of a lung-expansion injury tend to appear immediately after the dive. Yet, decompression sickness (DCS) symptoms usually appear several hours after diving.

This guide explains what lung overexpansion injuries can be caused by, the typical symptoms of lung overinflation, and how they can be prevented.

What Causes Lung Overexpansion Injuries?

After entry-level certification, scuba divers should know that the most serious lung-expansion injury is:

- Arterial Gas Embolism (AGE)
- Pneumothorax (collapsed lung)
- Mediastinal Emphysema
- Subcutaneous Emphysema (crackling under the skin)

These life-threatening emergencies cause scuba diving accidents and incidents that sometimes end in tragedy.

Generally, there are two reasons why divers suffer lung overinflation. The most common cause occurs after making a breath hold ascent. But, lung disease can also be a contributing factor for lung expansion - due to pathological air trapping.

***Pro Tip**: Inhaling compressed air from a scuba cylinder even at 1.2192 metres (4 fsw) before making a breath-hold ascent can tear alveolar sacs and cause lung barotrauma.*

Mechanism of Lung Overexpansion Injury

Expanding gas becomes an issue for scuba divers when they ascend in water (including 'free-divers'). In addition, the final few metres of the ascent are the most dangerous.

So, let's take a deep dive into lung anatomy.

Two main bronchi distribute air through the lungs. As they divide into bronchioles (smaller airways), they continue branching and narrowing in size. Eventually, the respiratory bronchioles will terminate as a pulmonary alveolus (air sac).

Gas exchange takes place in the alveoli. You should consider this as being the key functional unit of the respiratory system. This delicate membrane is only a few cell layers thick, yet it's encompassed by a huge capillary network - that's essential for breathing.

Holding Your Breath While Ascending

The question of what "holding your breath while ascending can lead to" is a simple one to answer. First of all, the volume inside your lungs will increase.

If this expanded volume exceeds the elastic limit of the alveoli, lung injury will occur. Following that, an injury of this nature can also force gas into the (any):

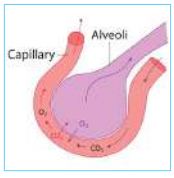
- Pleural space between the lung and the chest wall. The result will be an abnormal amount of air inside the chest cavity. In scuba diving, this condition is a pneumothorax (e.g. cardiovascular collapse).
- Interstitial space (e.g. tissue planes within the actual lung). From there, the gas may cause a mediastinal emphysema if it travels into the space around the heart and the tissues of the neck and larynx.
- Blood - causing a life-threatening condition known as arterial gas embolism (abbreviated to AGE). The injury may worsen if gas bubbles pass from the pulmonary capillaries to the left side of the heart. From there, they can travel to the carotid artery, or the basilar arteries at the front of the brainstem. If so, it can cause 'CAGE' (cerebral arterial gas embolism).

***Pro Tip**: Our section on scuba diving breathing techniques explains why the most important rule in scuba diving is to "breathe continuously and never hold your breath, especially when ascending in water".*

Lung Overexpansion Symptoms

The typical symptoms of lung overexpansion injury (such as pulmonary barotrauma) may include any, or all, of the following:

- Blueness in the lips (cyanosis)
- Change in voice
- Confusion
- Convulsion
- Dizziness
- Dyspnea (shallow, laboured, breathing)
- Heavy chest pain
- Hemoptysis (coughing up blood)
- Loss of vision
- Stroke or paralysis (particularly on one side of the body)
- Vomiting
- Unconsciousness (e.g. due to cardiac arrest)



Breathing in the normal manner, slowly and deep, through a scuba regulator is the appropriate method of keeping the airway open. Doing so, allows any expanding air to escape so that the alveolus keep their normal volume.

Holding your breath - and then blocking your airway - during an ascent means your lungs would over-expand and rupture, like an over-filled balloon.

In Conclusion

Overexpansion injuries rank as some of the most serious of all scuba diving injuries. This is because air can enter the bloodstream, and the chest cavity, leading to paralysis or death - in the worst cases.

As a result, the tendency for novice divers to hold their breath should be completely avoided. Even minor effects from decreasing pressure changes in shallow water can lead to trauma.

This is possibly the most dangerous example of all scuba bad habits vs. good habits. But, student divers can easily avoid life-threatening lung expansion injuries by continually breathing and not holding their breath.

***Pro Tip**: Trainers reaffirm the proper breathing techniques for anyone making the first scuba dive by having them blow a tiny stream of bubbles any time the student removes the regulator from their mouth.*

FAQ about Lung Overinflation

What is Lung Overexpansion Injury?

Scuba divers, skin divers, and freedivers with limited experience can suffer trauma in a breath-hold ascent.

So, the most common cause for pulmonary squeeze is a panicked bolt to the surface, such as when running out of air.

How Does Pulmonary Barotrauma Occur in Scuba Diving?

Anyone using SCUBA (Self-Contained Underwater Breathing Apparatus) must understand why holding their breath when returning to the surface is the number one rule to follow.

What is the First Aid for Lung Overexpansion?

The standard procedure for treating diving expansion injuries involves administering 100% oxygen and the immediate transportation of the victim to the nearest hospital or hyperbaric chamber.

Does Lung Barotrauma Go Away?

Victims often receive emergency treatment that involves the placement of a chest tube in hospital (e.g. for pneumothorax).

The treatment usually lasts for several days and complete recovery may take a few months. Hence, the risk of recurrence for divers who suffered a collapsed lung should not be overlooked.

***Pro Tip**: Check out our scuba diving safety facts for a list of medical contraindications that might stop you from going scuba diving.*

Related Information and Help Guides

- Accidents in Scuba Diving: Reports, Case Studies, and Insights
- Decompression Illness Signs, Symptoms, and Treatment
- How Would You Normally Provide Oxygen for a Breathing, Injured Diver?
- 9 Typical Signs of Shock Explained for Beginners
- What is the Current Scuba Diving Fatality Rate Worldwide?

***Note**: The tutorial video presented by DAN contains safety tips for beginners about simple techniques for preventing barotrauma in scuba diving.*

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