PRESSURE RELATED INJURIES

RESPIRATION

Respiration is the exchange of gasses such as oxygen, nitrogen and carbon dioxide between the blood and the external environment. Air taken in by the mouth and nose pass through the bronchial tree and into the lungs. Within the lungs, the bronchial tree branches many times into progressively smaller bronchi and finally into the alveolar. Alveoli are microscopic air sacs where gas exchange occurs. During gas exchanges, oxygen diffuses from the lung, through the alveolar walls and enters into capillaries where the blood stream flows. Likewise, carbon dioxide diffuses from the blood through the alveolar walls and enters the lungs where it is exhaled.

SCUBA diving effects normal respiration. In order to be a safe diver, you must understand these changes. When a trapped volume of air is pressurized (for example, our lungs on a breath hold snorkel dive) that volume decreases in size as we descend. The air also becomes more compact or dense. On ascent, the trapped air will return to its normal volume and density. On SCUBA, our lungs will always fill to their normal size. However the air that enters our lungs is more compact and dense in order to match the pressurized environment. The air that a diver breathes at 99 feet is denser than the air breathed at 33 feet. As we ascend the pressure around us decreases. As that pressure decreases, the SCUBA air expands and becomes less dense. If the diver breathes normally, they won't notice any differences in the air. **IF, HOWEVER, THE DIVER HOLDS THEIR BREATH AND FAILS TO EXHALE UPON ASCENT, SERIOUS DAMAGE TO THE LUNGS CAN OCCUR.** Over inflation of the lungs can cause the alveoli (air sacs) to burst similar to a balloon when over filled. When the alveoli burst, air then escapes into numerous passages. The following are common pressure related injuries caused by over inflation of the lungs and the areas where the air can escape.

AIR EMBOLISM

An air embolism is considered the worst of the pressure related injuries. When alveoli burst, the air escapes directly into the pulmonary veins and goes into the heart. From the heart, the bubble travels up the carotid arteries in the neck and into the small arteries and capillaries of the brain. Embolism comes from the word "embolus" meaning plug. Eventually the air bubble becomes stuck in the capillaries and forms a plug cutting off the blood supply to that area of the brain. The result is tissue death.

CAUSE:	Breath holding on compressed air (SCUBA).
SYMPTOMS:	Dizziness, vision disturbance, unconsciousness, breathing and/or circulatory arrest, and possible bloody froth from the mouth.
TREATMENT:	Lay victim down, elevate feet, and give 100% oxygen, recompression in a hyperbaric chamber. NEVER ATTEMPT IN WATER RECOMPRESSION!
PREVENTION:	**NEVER HOLD YOUR BREATH**

MEDIASTINAL EMPHYSEMA

Air can also pass out of the alveoli and into the mediastinum. The mediastinum is a viscera sac in the thoracic cavity and contains the heart, esophagus, trachea, thymus glands and lungs. Air pressure against these parts can produce numerous symptoms.

CAUSE: Breath holding on compressed air (SCUBA).
SYMPTOMS: Pain in center of chest, cyanosis (blue color), faintness, shortness of breath.
TREATMENT: Treat for shock; give artificial respiration and CPR if needed. IF IN DOUBT, TREAT AS AN AIR EMBOLISM.
PREVENTION: **NEVER HOLD YOUR BREATH**

SUBCUTANEOUS EMPHYSEMA

Air bubbles can travel up along the neck and under the skin of the neck and upper chest region. It is not considered serious by itself but is often associated with mediastinal emphysema.

CAUSE: Breath holding on compressed air (SCUBA).
SYMPTOMS: Fullness of throat, breathing difficulty, change of voice, crackling skin around neck and/or throat.
TREATMENT: Treat for shock, artificial respiration and CPR if needed, recompression isn't generally required unless other symptoms indicate need. SEEK SECONDARY MEDICAL TREATMENT.
PREVENTION: **NEVER HOLD YOUR BREATH**

PNEOMOTHORAX

Between the lungs and rib cage is a moist membrane called the pleural lining. If air escapes from the alveoli in the lungs, but not through the pleural lining, it can expand and cause the lung or lungs to collapse. This is called a pneumothorax, a rare but serious condition. The expanded air in the pleura space not only collapses the lung but also may press against the heart and affect circulation.

CAUSE: Breath holing on compressed air (SCUBA)
SYMPTOMS: Cyanosis (blue color) of lips, fingernails, pain on one side of chest, difficulty breathing, short/shallow breaths.
TREATMENT: Lie affected side down, treat for shock, surgical removal of trapped air unless it is small. SEEK SECONDARY MEDICAL TREATMENT!
PREVENTION: **NEVER HOLD YOUR BREATH**

NOTE: any or all of these injuries may occur at the same time. Symptoms usually occur as soon as a diver surfaces, but can occur up to several hours after a dive. **IF ANY OF THESE SYMPTOMS OCCUR AND YOU ARE UNSURE OF TREATMENT, TREAT AS AN AIR EMBOLISM!**