Mountain Flying Qualification Course

Civil Air Patrol

Auxiliary of the United States Air Force

Physiological Effects of Altitude

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OXYGEN DEPRIVATION (HYPOXIA)
SINUS PRESSURE
ULTRAVIOLET RADIATION

Definition of Hypoxia

Hypoxia is a lack of oxygen at the tissue level of the body due to a decrease of oxygen pressure in inspired air or because of conditions that interfere with the diffusion or absorption of oxygen within the body.

Types of Hypoxia

Histotoxic Hypoxia

- Interference of the tissue's ability to absorb or metabolize delivered oxygen
- Often caused by alcohol, narcotics, or poisons

Hypemic Hypoxia

- Reduction of the blood's ability to carry oxygen
- Carbon monoxide is most common cause
- Other causes: anemia, blood loss, and smoking

Hypoxic Hypoxia

- Lack of oxygen in the tissues due to decrease in the partial pressure of oxygen at altitude

Causes of Hypoxia

- Flight at an altitude where there is insufficient partial pressure of oxygen to cause oxygen transfer
- Ingestion or inspiration of drugs that interfere with the blood's ability to absorb or transport oxygen from the lungs to the cells
- Malfunction of the circulatory system
- Positive "g" forces preventing oxygenated blood from reaching the brain
- Mechanical malfunction of supplemental oxygen equipment

Symptoms of Hypoxia

The most common initial symptom is mild euphoria, making the self-detection of hypoxia less likely and more difficult. Every person's symptoms differ in order and severity, but often include:

- Decreased visual acuity
- Mental confusion
- Shallow, rapid breathing
- Cyanosis (blue) of the fingernails
- Headache
- Eventual incapacitation, followed by death

Prevention of Hypoxia

- Use lowest practical flight level
- Minimize duration of high-altitude operations
- Allow acclimatization to higher altitudes
- Refrain from alcohol and tobacco products
- Maintain good physical condition
- Use supplemental oxygen

Supplemental Oxygen

- Required for crewmembers when flying between 12,500 and 14,000 MSL for over 30 minutes
- Required for crewmembers at all times when flying above 14,000 MSL
- Must be provided to passengers above 15,000 MSL
- Will have beneficial effects at altitudes well below those required by regulation
- While the regulations require use of supplemental oxygen in terms of absolute altitude, the physiological effects of hypoxia result from density altitude. Base decisions regarding exposure to hypoxia on calculations of the density altitude at which you are operating.

Sinus Pressure

Air trapped in sinus cavities and the inner ear must be equalized during climbs and descents to prevent pain and tissue damage. Yawning during ascent is usually sufficient, but use of the Valsalva Maneuver during descent may be required:

- Close your mouth and keep it closed
- Pinch your nostrils closed tightly
- Force your tongue against the roof of your mouth
- Exhale forcibly through the upper throat into your nasal cavity until pressure is equalized

Ultraviolet Radiation

- Thin air at higher altitudes allows more damaging UV radiation from the sun to reach your cockpit.
- Protect exposed skin with sunscreen
- Wear sunglasses which block both UV-A and UV-B radiation.

Personal Equipment

- Wear layers of warm clothing
  - Aircraft heater may be ineffective or inoperative
  - Heater may not distribute air evenly throughout the aircraft
  - May be all you retain following rapid egress from aircraft
- Carry water in cockpit to prevent dehydration
- Augment normal aircraft survival gear
  - Mountains become very cold at night, even in the summer
  - Sleeping bag can be a lifesaver, especially if injured
  - High-calorie food necessary in low temperature environment
  - Traveling for water or shelter can be difficult in steep terrain


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