AEROSPACE CARDIOLOGY, LLC

Dr. John's Cockpit Consults

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SENIOR AVIATION MEDICAL EXAMINER FEDERAL AIR SURGEON'S CARDIOLOGY CONSULTANTS

"Dr. John S. Raniolo recommends having an oximeter on board and checking oxygen saturation levels approximately every 15 minutes."

HAZARDS OF HYPOXIA

How an Oximeter Could Save Your Life

A recent incident, regarding a pilot overcome with hypoxia, continues to remind pilots that this condition could be potentially fatal. On May 17, 2011, a couple was flying from San Bernardino, California to Colorado Springs, Colorado. The husband developed hypoxia and became unconscious, they were flying in instrument conditions and the wife had no choice but to attempt to fly the plane. (See article below) [1]

What is Hypoxia?

Hypoxia is a pathological condition in which the body as a whole (generalized hypoxia) or a region of the body (tissue hypoxia) is deprived of adequate oxygen supply. A mismatch between oxygen supply and its demand at the cellular level may result in a hypoxic condition.

When do you need Oxygen?

It is required by FAR 91.211: supplemental oxygen. This regulation specifies a 30-minute limit before oxygen is required on flights between 12,500 and 14,000 feet MSL, and immediately upon exposure to cabin pressures above 14,000 feet MSL. For best protection, it is recommended to use supplemental oxygen above 10,000 feet MSL. At night, because vision is particularly sensitive to diminished oxygen, a prudent rule is to use supplemental oxygen when flying above 6,000 feet MSL. (See FAR 91.211 below)[2]

What are the symptoms of Hypoxia?

You may not even recognize the symptoms of hypoxia because hypoxia is insidious in its onset. The signs and symptoms can be different for every person and may not occur in the same progression as listed below. Therefore, it is important to be aware of all the signs and symptoms:

Signs:

- Rapid Breathing
- Cyanosis
- Poor Coordination
- Lethargy/Lassitude
- Executing Poor Judgment

Symptoms:

- Air Hunger
- Dizziness
- Headache
- Mental and Muscle Fatigue
- Nausea
- Hot and Cold Flashes
- Tingling
- Visual Impairment
- Euphoria

Time of Useful Consciousness

Time of useful consciousness (TUC) is defined as the amount of time an individual is able to perform flying duties efficiently in an environment of inadequate oxygen supply. [1] It is the period of time from the interruption of the oxygen supply or exposure to an oxygen-poor environment to the time when useful function is lost, and the individual is no longer capable of taking proper corrective and protective action. It is not the time to total unconsciousness. The TUC has also been called Effective Performance Time (EPT). At the higher altitudes, the TUC becomes very short; considering this danger, the emphasis is on prevention rather than cure.

There are many individual variations of hypoxia, even within the same person. Generally, old age tends to reduce the efficiency of the pulmonary system, and can cause the onset of hypoxia symptoms sooner. Smoking drastically reduces oxygen intake efficiency, and can have the effect of reducing tolerance by 1,000-2,000 meters (approx. 3,000-6,000 feet). Hypoxia can be simulated in an altitude chamber. This can be useful for identifying individual symptoms of hypoxia, along with rough estimates of the altitude that causes problems for each person. Identifying symptoms is often helpful for self-diagnosis in order to realize when altitude should be reduced. Although the times in the table below are often called average TUCs, an average failure is meaningless to a person who has a shorter TUC.

"Generally, old age tends to reduce the efficiency of the pulmonary system, and can cause the onset of hypoxia symptoms sooner."

The table below reflects various altitudes with the corresponding average TUC[3]

Altitude in Flight Level	Time of Useful Consciousness	Altitude in meters	Altitude in feet
FL 150	30 minutes or more	4,572 m	15,000
FL 180	20 to 30	6,705 m	22,000
FL 250	3 to 6 minutes	7,620 m	25,000
FL 280	2.5 to 3 minutes	8,534 m	28,000
FL 300	1 to 3 minutes	9,144 m	30,000
FL 350	30 sec to 60 seconds	10,668 m	35,000
FL 400	15 to 20 sec	12,192 m	40,000
FL 430	9 to 15 sec	13,106 m	43,000
FL 500 ↑	6 to 9 sec	15,240 m	50,000

These times have been established from observations over a period of years and are for an individual at rest.

Dr. Raniolo's Personal Experience with Hypoxia

My personal experience occurred approximately 10 years ago. My wife and I were flying with another pilot. We began our flight to Page, Arizona flying at an altitude of 9,500. We experienced heavy chop, and the pilot decided to ascend to an altitude of 13,500, in an attempt to climb to smoother air. At 13,500 it was smooth, after approximately 15 minutes I began to feel somewhat euphoric, my wife in the back stated she was not feeling well, she experienced nausea and continued uneasiness. The pilot had oxygen for only two on board, one tank and cannula for himself and one for me. My wife and I shared the second cannula. After 30 minutes or more the pilot decided to descend, my wife and I quite relieved. I speculate the he (the pilot) only planned on being above 10,000 for 30 minutes or less, however, it didn't take even that long to experience effects from the lack of oxygen. After landing, subsequently, my wife and I experienced not only nausea, but extreme exhaustion. We were literally wiped out for the entire rest of the day. I realized at that time the severe effects of hypoxia on the body. I guarantee I never want to experience it again either.

"A normal saturation should register above 90."

Dr. Raniolo's Safety Recommendations

How to Avoid Hypoxia-Safety Precautions in the Cockpit

1. Check oxygen tanks, before flight, make sure you have adequate supply on board, just in case it may be necessary.

2. Consider amount of oxygen needed, for yourself, based on age, whether you or your passengers smoke, and health issues concerning lung capacity or cardiac conditions.

3. Make sure you have adequate oxygen for all passengers on board. (while, this is not necessary for FAR 91.211, it is recommended for their well - being and comfort)

4. Consider altitude and weather conditions. (you may have to fly at a higher altitude for weather conditions)

5. Don't always rely on the flow meter with your cannula.

6. HAVE AN OXIMETER ON BOARD. (This device will tell you if you are getting enough oxygen and also that you are maintaining the adequate levels of saturation to fly safely)

7. Alternate fingers used for the Oximeter, you may get a different reading on different fingers.

Dr. John S. Raniolo recommends having an oximeter on board and checking oxygen saturation levels approximately every 15 minutes. A normal saturation should register above 90. Any reading below that level and you should evaluate your oxygen on board; make sure your tanks are full and operating properly. If the reading continues to be below 90 for the pilot or any passengers on board, the decision to descend becomes immediate. Your Time of Useful Consciousness (TUC) is reduced depending on the altitude you are flying. It is imperative to descend safely to a lower altitude to avoid a potential hazard.

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Oximeters

Oximeters can be purchased easily with prices starting at $29.00 and are well worth the expense. An oximeter should be part of your safety equipment in your aircraft.

If you have any questions about this article, or a suggestion for future articles;

EMAIL Dr. John S. Raniolo at: info@aerospacecardiology.com

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Other references:
http://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hypoxia.pdf

[1]Reference Article

Wife takes controls of plane when husband passes out

Woman was 'coached' to fly via radio

DENVER -- A woman took over the controls of a small airplane when her pilot-husband started having trouble breathing and speaking on a flight from **California** to **Colorado**, authorities said.

The **Federal Aviation Administration** released details and audio of the incident Thursday, which happened on a trip from **San Bernardino**, Calif. to **Colorado Springs** May 17.

Ground controllers in Colorado and a Great Lakes Airlines pilot in another plane helped her guide the smaller craft.

LISTEN TO THE AUDIO COMMUNICATIONS HERE

The specifics of the man's medical problem weren't available.

An air traffic controller in Longmont, Colo., noticed the 70-year-old pilot appeared to have difficulty breathing during a routine conversation they were having.

Documents released Thursday indicate the pilot may have had hypoxia, which is when the body is deprived of an adequate supply of oxygen.

The woman said her husband was slurring his speech and was unable to push the buttons.

The controller said he wasn't able to make contact with the pilot after the plane began to make erratic maneuvers.

The pilot's wife got on the radio to say her husband had been incapacitated and could not fly, and she said she did not know how.

The woman can be heard saying, "I can't talk much cause I got to hold the oxygen to my face and the mic, and I can't tell what's going on."

"My main concern was getting the Cirrus down to a lower altitude where the pilot would be able to breathe in more oxygen and become more coherent," Charlie Rohrer says. "I also wanted to keep the pilot’s wife calm so she would be able to handle the aircraft until the pilot began to recover."

"While I communicated with the pilot and his wife, other Denver center personnel provided me with information on this particular Cirrus model, directed other planes in the area and arranged to keep additional flights out of the sector so I could focus on helping the people in the Cirrus," Rohrer says.

A pilot from a Great Lakes airplane heading to **New Mexico** began flying toward the single-engine Cirrus SR22 to offer assistance.

"The Great Lakes flight crew helped immensely by providing the Cirrus pilot with advice and his wife with information on how to control the plane," says Rohrer. "I was very glad to have them on frequency."

The commercial pilot managed to instruct the woman on how to turn the autopilot on and begin a controlled descent.

The FAA says the autopilot didn't work properly.

The man regained consciousness as the plane descended, though the Great Lakes Airlines pilot reported that he was incoherent and argumentative.

"I can tell by how he's talking, he's conscious, but he can't think straight whatsoever," said the commercial pilot.

At one point, the plane swerved away from its emergency landing route and began heading toward the high terrain of the San Juan mountains. As the plane began to drop, the controller attempted to reach the passenger so she could turn the plane away from the mountains. The controller eventually guided the plane toward lower terrain.

The man who was experiencing difficulty recovered in time as the plane descended and was able to land safely in Farmington, N.M.

The Associated Press contributed to this report

[2] FAR Section.91.211

Code of Federal Regulations

Sec. 91.211

Part 91 GENERAL OPERATING AND FLIGHT RULES	
Subpart C--Equipment, Instrument, and Certificate Requirements	

Sec. 91.211

Supplemental oxygen.

(a) *General.* No person may operate a civil aircraft of U.S. registry--
(1) At cabin pressure altitudes above 12,500 feet (MSL) up to and including 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration;
(2) At cabin pressure altitudes above 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen during the entire flight time at those altitudes; and
(3) At cabin pressure altitudes above 15,000 feet (MSL) unless each occupant of the aircraft is provided with supplemental oxygen.
(b) *Pressurized cabin aircraft.*

(1) No person may operate a civil aircraft of U.S. registry with a pressurized cabin--
(i) At flight altitudes above flight level 250 unless at least a 10-minute supply of supplemental oxygen, in addition to any oxygen required to satisfy paragraph (a) of this section, is available for each occupant of the aircraft for use in the event that a descent is necessitated by loss of cabin
pressurization; and
(ii) At flight altitudes above flight level 350 unless one pilot at the controls of the airplane is wearing and using an oxygen mask that is secured and sealed and that either supplies oxygen at all times or automatically supplies oxygen whenever the cabin pressure altitude of the airplane exceeds 14,000 feet (MSL), except that the one pilot need not wear and use an oxygen mask while at or below flight level 410 if there are two pilots at the controls and each pilot has a quick-donning type of oxygen mask that can be placed on the face with one hand from the ready position within 5 seconds, supplying oxygen and properly secured and sealed.
(2) Notwithstanding paragraph (b)(1)(ii) of this section, if for any reason at any time it is necessary for one pilot to leave the controls of the aircraft when operating at flight altitudes above flight level 350, the remaining pilot at the controls shall put on and use an oxygen mask until the
other pilot has returned to that crewmember's station.

[3]Mark Wolff (2006-01-06). "Cabin Decompression and Hypoxia". theairlinepilots.com.

http://www.theairlinepilots.com/medical/decompressionandhypoxia.htm. Retrieved 2008-09-01