MEDICAL FITNESS FOR PILOTS

by Capt K. Haroon

Just like the aircraft, a pilot is also required to undergo regular checkups and maintenance to ensure fitness to fly. One does not have to be perfect to fly since many deficiencies can be compensated for e.g., spectacles for vision or a medical flight test to demonstrate that you can compensate for a certain defect like noise induced hearing loss etc.

With advancement of technology, equipment reliability has increased a lot. However, equipment reliability alone will not increase flight safety. The pilot who is an integral part of the man-machine system has to be equally reliable to keep the flight safe. Overlooking pilot's fitness is equivalent to overlooking the preflight checks. Rules and regulations do not help unless pilot himself is responsible for determining his fitness prior to flight. Following are some factors which a pilot must be familiar with.

GENERAL HEALTH

A pilot must be free of conditions which are harmful to:

- Alertness.
- Ability to make correct decisions or affect reaction times.

The conditions affecting alertness or decision making may or may not be related to a disease e.g., fasting itself is not a disease but its effects impair alertness, decision making and reaction times. That is the reason pilots should abstain from fasting while flying. Similarly, some emotional factors play the same role and upsets general health leading to the same consequences as discussed above. There is no way that any authority, procedure or protocol can detect that a pilot is not feeling well before the flight. It is the pilot himself who has to decide if he is fit for the flight or not. Therefore, consult your medical examiner when in doubt about any aspect of your health, just as you would consult a technician when in doubt about your equipment. Other than general health conditions there are some specific aeromedical factors that will affect flight safety if not checked in time. These are mentioned below.

FATIGUE

Fatigue generally slows the reaction times and causes errors due to inattention. The most common causes of fatigue are:

- Insufficient rest.
- Loss of sleep.

While some important contributing factors to fatigue can be:

- Family problems.
- Business and Financial problems.

What are you supposed to do if you figure out that you are fatigued prior to your flight? – Don't fly! Ensure you have a good night's sleep before you fly and do not allow scheduling pressures to prevents this. If you must discuss your condition then consult a medical specialist and not a scheduling officer. Response to scheduling request should just be "Yes" if feeling fit or "No" if not feeling fit. Responsible decision-making yields better results than lengthy explanations.

HYPOXIA

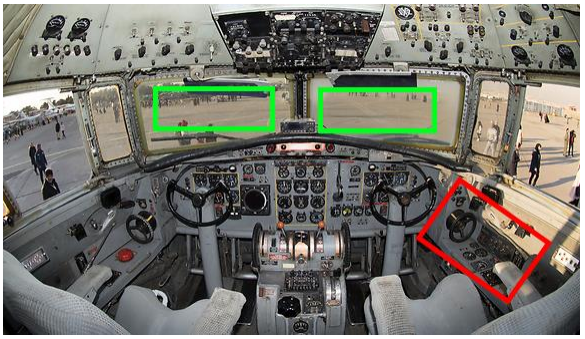
Hypoxia, in simple terms, is a lack of oxygen to keep the brain and body tissues functioning properly. Individual variation occurs with respect to susceptibility to hypoxia. In addition to lack of oxygen at higher altitudes, anything interfering with the blood's ability to carry oxygen can contribute to hypoxia e.g., anemias (also referred to as low hemoglobin, is a condition in which you lack enough healthy red blood cells to carry adequate oxygen to your body's tissues). Carbon monoxide and some drugs can also cause hypoxia.

The tricky part is how to detect if you are suffering from hypoxia since there is no built-in alarm system to let you know when you are not getting enough oxygen. A major early symptom of hypoxia is an increased sense of well-being (referred to as "euphoria"). This progresses to:

- Slowed reaction.
- Impaired thinking ability.
- Unusual fatigue.
- Dull headache.

The symptoms are slow but progressive, insidious in onset, and become marked at altitudes above 10,000 feet. Night vision, however, can be impaired at altitudes even lower than 10,000 feet. No matter how much you theoretically know about it, unless you have experienced it or are trained for its detection, it is not that easy to figure out that you are suffering from hypoxia. Since training for hypoxia detection is not considered a mandatory training item in routine airline operations, the only hint that should ring the bells is slow reactions, impaired thinking ability, fatigue or headache.

I remember experiencing hypoxia on one of my flights in my early career as an FO on F27. The aircraft (F27) was an old Dutch turbo prop made in 1950's. Unlike the modern cockpit it did not have the typical Electronic Centralized Aircraft Monitor (ECAM) that could draw the pilot's attention if cabin altitude climbed above 10,000 feet. The only indication was a caution light that illuminated if cabin altitude crossed 10,000 feet. The location of the light was somewhere on the right side of FO's seat where the pressurization panel was (as shown by the red outlined area in the image below). The light was totally out of view if you were looking out of the main windows.



It was a VFR flight and we were flying over high terrain with cloud base between us and the terrain. Both me and the captain were looking for a gap in the clouds so that we could initiate our descent. During this time, I felt that something was wrong with me as I was finding it hard to concentrate. I was thinking whether I should inform the captain about it or just ignore it. It was only when I looked at the captain that I realized that I was suffering from hypoxia as he headed towards his oxygen mask and asked me to wear it too. Since I was studying in a medical college learning medicine before starting flying, I knew much more about hypoxia as compared to what an average pilot would study about it in aviation but lack of experience in identifying the symptoms rendered the theory useless. The depressurization that occurred took the cabin altitude to 19,000 feet without any aural warning and since it was a VFR flight and we were looking outside finding a gap in the cloud for our descent (without autopilot as it was not installed in that plane), the caution light was totally out of view. Nevertheless, once we identified the problem, we took the corrective actions and all ended well.

As discussed above; slow reactions, impaired thinking ability, fatigue or headache should ring the bells for you. Don't be shy to talk about it or grab the oxygen even if your diagnosis is wrong. It can be a life saver.

ALCOHOL

Typical regulations demand a minimum of 8 to 24 hours of abstinence from alcohol before reporting for duty along with some blood alcohol level restrictions. With a significant amount of alcohol, performance can be affected up to 48 or even 72 hours after the last drink, because of a hangover effect. Even small amounts of alcohol in the system can adversely affect judgement and decision-making abilities. The body metabolizes alcohol at a fixed rate, and coffee or medication does not affect this. So do not fly under the influence of alcohol with a hangover or a "masked hangover" (symptoms suppressed by aspirin or other medication).

MEDICATION

Self-medication and flying can be hazardous. Simple "over-the-counter" medicines such as aspirin, antihistamines, cold tablets, cough mixtures, laxatives, tranquillizers and appetite suppressors may have unwanted effects. Herbal remedies can also have significant adverse effects. The safest rule is to take no medicine while flying, except if allowed by the aeromedical advisor. The condition for which the medicine is required may of itself be hazardous to flying, even when the symptoms are suppressed by the medication.

Certain specific medicines which have been found in post mortem samples after fatal aircraft accidents are: antihistamines (widely prescribed for hay fever and other allergies); tranquillizers (prescribed for nervous conditions, hypertension, sleep disorders and other conditions); weight-reducing drugs (amphetamines and other appetite suppressing drugs can produce sensations of well-being which have an adverse effect on judgement); barbiturates or nerve "tonics" (barbiturates produce a marked suppression of mental alertness).

Following general anaesthesia, a period of at least 48 hours should be spent on the ground. Twelve hours is reasonable for a local anaesthetic. Seek medical advice for any doubt about the required time period on ground before flying.

SPATIAL DISORIENTATION

On the ground we know which way is "up" by the combined use of three senses:

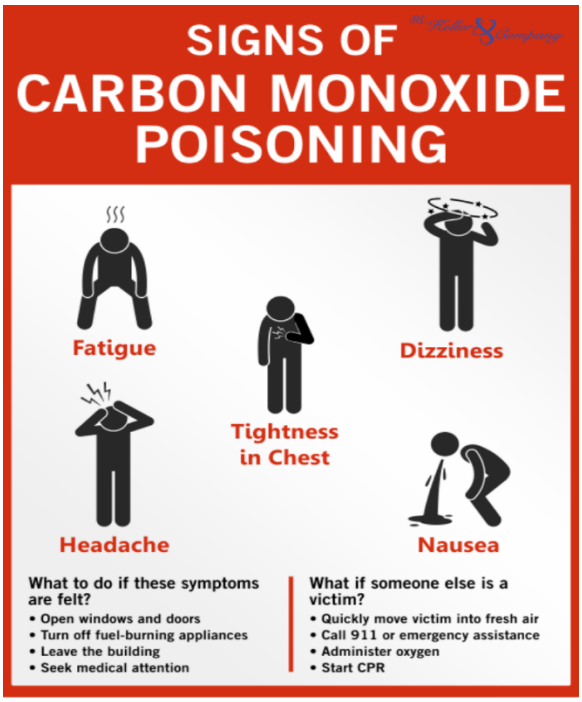
- Vision – Where We Are? – By seeing in relation to fixed objects;
- Pressure – Which Way is Down? – Gravitational pull on muscles and joints;
- Otoliths – Which Way is Down? – Gravitational pull on special parts in our inner ear.

Rotation of head (change of angular position) is detected by fluid in the semi-circular canals of the inner ear. However, in the absence of a visual reference (flying in instrument meteorological conditions) the rotatory accelerations can be confusing because their forces can be misinterpreted as gravitational pulls on the muscles and otoliths. The result is often disorientation. Many accidents have occurred when pilots without adequate instrumentation in the cockpit or without proper training in instrument flying have flown into IMC, and have become disorientated.

Disorientation can occur at night, and in any flight condition when outside visibility is reduced to the point that the horizon is obscured. Light flickering at certain frequencies (4 – 20 times per second) can lead to flicker vertigo in some individuals. The reactions may include nausea, dizziness, unconsciousness, or even reactions similar to an epileptic fit. In a single engine propeller aeroplane heading into the sun, the propeller may cut across the sun to give this flashing effect, particularly during landings when the engine is throttled back and propeller rotation is relatively slow. These undesirable effects may be avoided by not staring directly through the propeller for more than a moment, and by making frequent but small changes in RPM. The flickering light traversing helicopter blades has also been known to cause this effect, as has the reflection from rotating beacons on aircraft while flying in clouds. If the beacon is bothersome, shut it off during these periods, advise air traffic control and remember to turn it back on when clear of clouds. Strobe light in fog can have the same effect.

CARBON MONOXIDE

Carbon monoxide (CO) is a colourless, odourless, tasteless product of an internal combustion engine. CO concentration in exhaust fumes of a piston engine is much greater as compared to a turbine engine, therefore CO poisoning from turbine engine exhausts is rare. CO has a greater ability to combine with haemoglobin as compared to oxygen. If absorbed, it sticks “like glue” to the haemoglobin and prevents oxygen from attaching to it. Most cockpit heaters in light aircraft work by air flowing over the exhaust manifold, being heated and then delivered to the cockpit. So, if you have to use the heater, be careful if you smell exhaust fumes — there may be a leak from the engine exhaust pipe into the air used for cockpit warming. The onset of symptoms is insidious, with “blurred thinking”, a possible feeling of uneasiness, and subsequent dizziness. Later headache occurs. Immediately shut off the heater, open the air ventilators, descend to lower altitudes, and land at the nearest airfield. It may take several days to fully recover and clear the body of CO. Use of CO detectors in the cockpit is helpful, since affected pilots may otherwise be completely unaware that they are being exposed to CO.

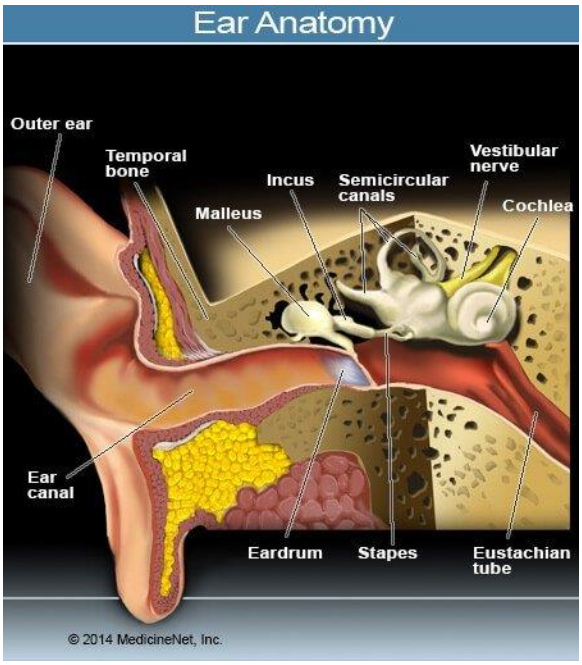


VISION

The choice of tints for use in the aviation environment should be limited to those that optimize visual performance while minimizing color distortion. To avoid eye fatigue in bright light, use sunglasses with neutral colour lenses instead of coloured ones. Gray (neutral density filter) is recommended because it distorts color the least. Neutral density filter means the light is blocked in a neutral way without changing the colour of the light.

If you use correcting lenses for good vision make sure to keep an extra pair, so that you can use them if you lose or break your first pair, or develop problems with contact lenses if you wear them.

MIDDLE EAR DISCOMFORT OR PAIN



Some people (pilots or passengers) have difficulty balancing the air pressure on either side of the ear drum while descending. Sometimes pressure equalization can occur at different times in each ear, resulting in a form of disorientation named "alternobaric vertigo". Problems arise if a head cold or throat inflammation keeps the Eustachian tube (passage from the middle ear to the throat) from opening properly. If this trouble occurs during descent, try swallowing, yawning, or holding the nose and mouth shut and forcibly attempting to exhale (Valsalva manoeuvre — pilots should know how to do this manoeuvre, and if you do not, ask your medical examiner about it). If no relief occurs, climb back up a few thousand feet (if feasible) to relieve the pressure on the eardrum. Then descend again, using these measures. A more gradual descent may be tried. A nasal inhaler may afford relief. If trouble persists several hours after landing, consult your aeromedical specialist.

If you develop symptoms of a cold when airborne, you may possibly avoid trouble by using a nasal spray, kept as part of the flight kit. However, take aeromedical advice before purchasing one. Flying with an upper respiratory infection increases the risk of developing middle ear or sinus problems.

SCUBA DIVING

Flying after scuba diving using compressed air requires a minimum rest period on ground. Not following this limitation can have serious medical consequences, and can even be fatal. Due to highly increased pressure underwater, nitrogen is absorbed into the blood and tissues. The amount absorbed depends on the depth and duration of dive. There needs to be a considerable period on the ground for the body to rid itself of excess nitrogen. If you become airborne too soon then nitrogen gas may form bubbles in the blood or tissues causing discomfort, pain, difficulty in breathing, or even death (even at lower altitudes like 7,000 ft or less). Overweight and obese individuals are more susceptible due to increased nitrogen absorption in the fatty tissues. Increased BMI implies an increased fat content of the body. This increased body fat leads to increased nitrogen storage and hence possible excessive nitrogen bubble formation and thus increased risk of development of decompression sickness.

Old age itself doesn't necessarily increase the inherent risks of scuba diving, but some health conditions that can accompany old age can be troublesome when combined with scuba diving e.g., a minor cardiovascular incident might make you feel ill or slightly faint on land, but will be manageable with the right help. However, if this happens underwater, you can drown since getting the right help under water is much more difficult.

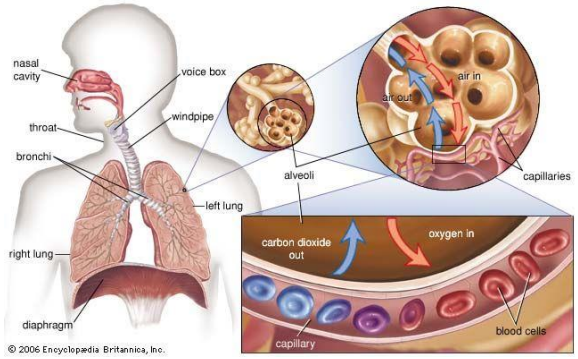
As a rule of thumb, one should not fly within 12-48 hours after diving using compressed air. Precise time depends on the depth and duration of dive. Diving organizations like PADI (Professional Association of Diving Instructors | www.padi.com) and NAUI (National Association of Underwater Instructors | www.naui.org) can be contacted for detailed info on this. An online resource that I've found useful for divers is the "Divers Alert Network" (www.dan.org). It is a group of not-for-profit organizations dedicated to improving diving safety for divers.

I've been diving since many years along with flying jets without any problem. However, the key to safe operation is religiously following the safety protocols like proper surface interval before flying and other limitations that are taught during your diving certifications. An inflight medical emergency can arise if a diver is unable to adequately decompress in his surface interval on ground. Sometimes the only feasible option is to send the patient to a recompression chamber in time to treat the condition. Flight in this case should be at the lowest possible altitude to avoid aggravating the condition.

HYPERVENTILATION

Hyperventilation, or over-breathing, is a respiratory disturbance that can occur as a result of emotional stress, anxiety, fright or pain. Increase of breathing rate causes an increase in ventilation which leads to removal of more carbon dioxide from the lungs than is produced by the body. The upset in balance causes reduction in body CO2 levels. Low CO2 levels lead to narrowing of the blood vessels that supply blood to the brain. The reduction in blood supply leads to symptoms like:

- Dizziness.
- Hot and cold sensations.
- Tingling of hands, legs and feet.
- Muscle spasms.
- Nausea.
- Sleepiness.
- Finally, unconsciousness in case of severe hyperventilation.

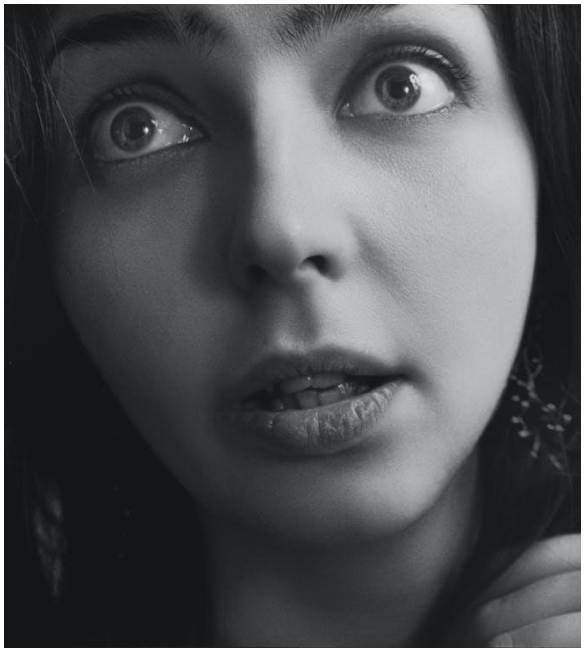


If an individual is behaving in an unusual manner, you can suspect:

- Hyperventilation
  Or
- Hypoxia

Since the initial symptoms are similar, assume it is hypoxia and supply 100% oxygen. If the condition was hypoxia, recovery will be rapid. However, if symptoms persist, it's probably because of low CO2 levels. In order to increase the amount of CO2 in the lungs, consciously slow the breathing rate until symptoms clear, then resume normal breathing rate. Breathing can be slowed by breathing into a paper bag as expired carbon dioxide is re-breathed.

PANIC



Panic can give rise to a vicious circle with unwise and impulsive actions resulting in increased anxiety. If lost or in some other fix, forcibly take control of yourself and do not allow panic to surface. Fear is a normal protective reaction and occurs in normal individuals. If you believe it occurs frequently or too easily to you, seek medical advice — there are techniques that can be learned and used to reduce the effects. Knowledge about your work, clear concepts and confidence are useful tools to combat panic and fear. If the panic attacks are due to anxiety, treatment options can include:

- Medications.
- Psychotherapy, including cognitive behaviour therapy.
- Biofeedback therapy.
- Stress management techniques.
- Proper breathing techniques.
- Relaxation techniques.
- Learning problem-solving skills.
- Lifestyle adjustments, such as attention to diet, exercise & sleep.

BLOOD DONATIONS

Body needs some time to readjust after blood donation. Donated blood is replenished in 4 to 8 weeks, while the blood plasma gets replenished within 48 hours. Unless advised otherwise, a minimum of 24 hours rest before flying is a must after donating blood. While most donors do not experience any side effects, some people are known to show some symptoms after blood donation. The side effects of donating blood include nausea and dizziness and fainting in some cases.

A person with low blood count or low blood pressure should refrain from donating blood. If you are underweight, you should not donate blood as the risk of nausea or fainting is high. In case you feel dizzy, lie down so that the blood flows to the brain, which will help in preventing fainting. Sitting down with head lowered forward between the knees can also help in better blood circulation to the brain. It is advisable to increase the intake of iron-rich foods after blood donation for quicker recovery. Since the blood completely replenishes itself within 4 – 8 weeks, you can donate blood every 56 days. However, red blood cells can only be donated 3 times a year, with a gap of 112 days in between.