



Migraines, Other Severe Headaches Hinder Pilot Performance

Even mild headaches can distract pilots from their flight duties; more severe headaches can be temporarily disabling. Many civil aviation authorities say that pilots who experience migraines are not fit to fly; some allow flight with restrictions.

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FSF Editorial Staff

Headaches are among the most common medical ailments. They can be symptoms of a variety of disorders, some of them serious and others relatively inconsequential and short-lived (see “Headache Warning Signs,” page 2). Headaches can impair a pilot’s abilities, and in rare occurrences, headaches have been cited as factors in aviation accidents. Pilots who experience some types of headaches often are denied medical certification.

Because of a scarcity of data worldwide, medical specialists have been unable to determine the prevalence of some types of headaches, but specialists say that other types are common and can be disabling.

The United Nations World Health Organization (WHO) said that, together, migraines and tension-type headaches have the greatest effect on public health.¹

“These common neurological complaints impose a significant health burden, with nearly all migraine sufferers and 60 percent



of those with tension-type headaches experiencing reductions in social activities and work capacity,” WHO said in the report *Headache Disorders and Public Health*. “Despite this, both the public and the majority of health-care professionals tend to perceive headache as a minor or trivial complaint. As a result, the physical, emotional, social and economic burdens of headache are poorly acknowledged in comparison with those of other, less prevalent neurological disorders.”

Migraines are one type of vascular headache (a headache involving blood vessels in the brain). They typically are recurrent, intense, throbbing headaches that often affect only one side of the head. They may be accompanied by loss of appetite; nausea; vomiting; increased sensitivity to light, sounds or odors; visual disturbances such as blind spots or the appearance of flashing lights; cold hands and cold feet; inability to concentrate; difficulty speaking; and loss of coordination.

Researchers believe that migraines are caused by abnormalities in some cell populations in the brain. The U.S. National

Institute of Neurological Disorders and Stroke (NINDS) says that researchers have used imaging technologies to observe changes in the brain during a migraine.

“Scientists believe that there is a migraine pain center located in the brain stem, a region at the base of the brain,” NINDS said. “As neurons [nerve cells] fire, surrounding blood vessels dilate and become inflamed, causing the characteristic pain of a migraine.”²

Until recently, researchers believed that migraines occurred when the arteries carrying blood to the brain narrowed and then dilated, activating pain receptors. The cause of the narrowing and dilation was believed to have been related to unusually low levels of serotonin, a chemical active in nerve cell communication. (Serotonin influences sleep, mood, appetite and other bodily functions; research involving serotonin has led to medications to treat migraines, depression, hypertension and other disorders.)³

There are two primary types of migraines: migraine with aura (classic migraine) and migraine without aura (common

migraine). An aura is a set of neurological disturbances, often visual disturbances (blurring of vision or the appearance of flashes of light) or a tingling or weakness on one side of the body, that precedes the headache and that typically continues for 15 minutes to one hour. Migraine without aura also may have warning signs in the hours or days before the onset of a migraine headache, such as tiredness, food cravings, changes in mood, irritability, restlessness or an increase in energy.⁴

Migraines can last for two hours to three days. Twenty-five percent of people who experience migraines have more than one a week; others may experience no more than one a year, WHO said. Migraines may affect people of any age, but typically they first occur between ages 10 and 30 and they may stop after age 50. Women are more frequently affected than men, and specialists believe that the tendency to have migraines may be genetic.⁵

Worldwide, the prevalence of migraines varies. WHO cited studies that found that during a 12-month period in Europe and North America, about 10 percent to 15 percent of adults experience migraines. In Africa, the prevalence is between 2.9 percent and 7.2 percent, and in Japan, the prevalence is 8.4 percent.

Migraine headaches can be triggered by a variety of factors, including lack of food, lack of sleep, exposure to elevated levels of light or sound, anxiety, stress and fatigue. In women, hormonal changes associated with menstruation, birth-control pills or hormone-replacement therapy also may trigger migraines. Red wine, aged cheese, chocolate and other foods also have been identified as possible triggers.

Some migraines are relatively mild; others can be so severe as to be temporarily disabling.

Headache, Aura Reduce Fitness to Fly

The International Civil Aviation Organization (ICAO) *Manual of Civil Aviation Medicine* said that either the headache or the aura of a migraine “may impair the ... ability to make decisions in the air.”⁶

“Consider first the aura in relation to fitness for flying,” the manual said. “Binocular loss of central vision seriously reduces the pilot’s sensory input and impairs his efficiency in various ways. Unable to read his instruments, the pilot cannot tell his position in space. Similarly, a scotoma [a dimming of vision or a blind spot in the visual field] makes it very difficult to land an aircraft as it interferes with ability to judge height above the ground. ... Even more disturbing to the crewmember is an aura of diplopia [double vision]. ... Loss of sensation in a hand, another common migraine aura, is a great handicap in the cockpit, where so many fine controls need to be manipulated. Some migraine sufferers know an attack is imminent because of mood change, usually one of elation,

Headache Warning Signs

Rarely, headaches can be indications of serious medical conditions. Specialists advise people to seek medical attention if any of the following occur:¹

- Headaches occur three times a week or more;
- Pain-relief medication is taken daily — or almost daily — or is taken in larger-than-recommended doses to relieve headaches;
- Headaches worsen or change in character (for example, if rare headaches become frequent);
- Headaches begin after age 50;
- Headaches begin after a head injury, exertion, coughing, bending or sexual activity; or,
- A headache is accompanied by stiff neck; fever; shortness of breath; unexpected symptoms involving vision, hearing or smell; dizziness, unsteadiness, slurred speech, weakness, numbness or a tingling sensation; confusion or drowsiness; and/or persistent or severe vomiting.♦

Note

1. *What You Should Know About Headache: When to Call Your Doctor*. American Council for Headache Education. <www.achenet.org/understanding>. Nov. 11, 2002.

which may seriously interfere with decision making by impairing judgment.”

Claus Curdt-Christiansen, M.D. chief of the ICAO Aviation Medicine Section, said that migraines “are usually so unpredictable and so disabling (including the visual disturbances during the aura of a classic attack) as to be incompatible with safe flying.”⁷

Nevertheless, he said, “There may be very mild forms with infrequent attacks, usually those where the triggering factors are well-known and easy to avoid and where the pilot can function during an attack (and where mild analgesics, unlikely to affect flying performance, are sufficient). In such cases, flexibility [in granting medical certification] ... could be considered in trained pilots.”

A greater degree of flexibility is possible in conducting medical assessments of private [general aviation] pilots than air transport pilots because private pilots “generally can avoid flying on a ‘migraine day’ or during periods with many [migraine] attacks,” he said. “For commercial pilots, this is much more difficult.”

Annette Ruge, M.D., Ph.D., medical coordinator for the European Joint Aviation Authorities (JAA), said that, although each case is judged individually, JAA considers frequent migraines “incompatible with any form of flying” and that an initial applicant for a Class 1 medical certificate generally should be assessed as unfit if he or she has a history of migraines “because the disease is unpredictable and frequently disabling.”⁸

A commercial pilot who develops migraines later in his or her career must undergo further neurological assessment and, if no underlying disease is found and the pilot has no migraines for three months to six months, he or she may be assessed as fit to fly, but only as a member of a multi-pilot crew, Ruge said. A medical certificate might be issued without that restriction if the migraines are infrequent and caused by a specific trigger and if avoidance of that trigger results in a two-year absence of migraines, she said. (A private pilot may be permitted to fly without the restriction if the migraines are mild and if they occur no more than twice a year.)

In the United States, the U.S. Federal Aviation Administration (FAA) *Guide for Aviation Medical Examiners* says that pain from migraines can be “acutely incapacitating” and can “preclude issuance of a medical certificate.” Nevertheless, under some conditions, applicants with infrequent, mild migraines can receive discretionary issuances (waivers) of medical certificates.⁹

Warren Silberman, D.O., M.P.H., manager of the FAA Civil Aerospace Medical Institute Aerospace Medical Certification

Division, said that each case is examined “on its own merits” and that in assessing an applicant with migraines, FAA should have a note from the physician who has treated the applicant explaining how frequent the migraines are and what treatment relieves them.

“We also would like a detailed description of the characteristics of the headache,” Silberman said. “Is there an aura, problems with confusion, any neurologic signs such as numbness or tingling, visual defects, etc.? If there are neurologic deficits, there is a chance that medical certification would not be possible.”

“We would like the airman to be in remission — that is, no headache for six months,” Silberman said. Nevertheless, he said that medical certificates have been issued to some pilots who have experienced headaches less than six months before certification.¹⁰

In one report filed with the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System,¹¹ the first officer of a Boeing 747-400 described an event in which the captain complained of a migraine during a flight from Japan to the United States:

Migraines “are usually so unpredictable and so disabling ... as to be incompatible with safe flying.”

The captain asked me to take over the radio and flight-plan-monitoring duties because he did not feel well. He stated that he had gotten a migraine headache and felt nauseous as well. On one occasion, he attempted to question whether I had made a report or not and was not able to get the words out.

At this point, I could see that he was in great pain and suggested that we wake up a relief pilot early, which I did shortly thereafter. ... The captain [after a rest period] was worse rather than better and elected to sit in the second jump seat for the remainder of the flight.

As senior copilot, I flew the approach, landed and taxied to the gate. The other copilots occupied the captain’s seat and center jump seat and operated as we normally would. The flight was operationally uneventful. Although the captain was not unconscious, his ability was impaired. It would be difficult to say that he was incapacitated. His decision to utilize extra crewmembers showed good judgment in this case. Many pilots would have been tempted to ‘tough it out’ to the possible detriment of air safety.¹²

The Australian Transport Safety Bureau cited a pilot’s “severe migrainous-type headaches” as a significant factor in an Aug. 18, 1998, accident in which the pilot was killed and the Bell 206B JetRanger was destroyed.¹³

The accident report said that an investigation revealed no defects in the helicopter that would have contributed to the

accident. Medical records, however, indicated that the 11,997-hour pilot had visited a designated aviation medical examiner (DAME) on July 28, 1998, a neurologist on Aug. 5 and Aug. 10 and an ear, nose and throat specialist on either Aug. 14 or Aug. 17 because he had begun experiencing headaches, accompanied by blurred vision and double vision. The DAME said that the headaches might be related to emotional stress and referred the pilot to the neurologist, who detected no neurological problems; the ear, nose and throat specialist diagnosed a sinus infection and prescribed antibiotics.

The report said that the pilot had experienced a headache early in the morning of the accident flight.

As a result of the accident, the Australian Civil Aviation Safety Authority published an article in its aviation safety publication intended to emphasize the risks of flying while suffering from headaches and other “apparently minor” medical problems.

That article said, “Even a simple headache can be a distraction, and if it is a migraine headache, it can be incapacitating. Attempting to deal with in-flight problems (aircraft emergency, deteriorating weather) while suffering from a headache is likely to be a hindrance at the very least, and may well make the headache worse.”¹⁴

Several Options Exist for Migraine Treatment

Because the type and severity of migraines vary, so does treatment.

Typically, medication is used to treat migraines, although acupuncture also is considered effective against migraines and other headaches (see “Acupuncture Helps in Treating Medical Problems” by Stanley R. Mohler. *Human Factors & Aviation Medicine* Volume 49 [September–October 2002]). The following two categories of medication are administered most frequently:¹⁵

- Prophylactic medications are used to prevent migraines or to decrease their frequency and intensity. Medications in this category include beta blockers and calcium channel blockers, which also are prescribed to control elevated blood pressure and irregular heart rates. These medications must be taken daily for full effectiveness; and,
- Abortive medications are used to treat symptoms after they occur. Medications in this category have included those that contain ergotamines, barbiturates and codeine — all of which are considered unacceptable for use by pilots — and caffeine and analgesics (acetaminophen and aspirin) — which are considered acceptable in some circumstances — and have been administered by

mouth, injection, nasal spray or rectal suppository. More recently, triptan medications — which are considered acceptable in some circumstances — have been shown to be effective in the treatment of all classes of migraines.

Curd-Christian said that most medications used to treat migraines are incompatible with the conduct of flight duties.

Depending on the circumstances of each pilot’s case, however, mild analgesics can be acceptable, as can caffeine — in coffee and in tablets — “up to a limit,” he said. He said that one type of triptan medication — sumatriptan — is not always effective and can cause fatigue and drowsiness.

“Prophylactic treatment is warranted when the migraine attacks are frequent,” Curdt-Christian said. “Most of the prophylactic drugs used ... have significant side effects and do not prevent *all* attacks. Very few pilots on prophylactic treatment would qualify for more than a restricted license (with or as co-pilot or similar); the majority would be unacceptable in the cockpit.”

Nevertheless, depending on the circumstances, medical certification might be granted to some pilots being treated with prophylactic medications such as beta blockers, “but individual evaluation and close supervision are required,” he said.

“It is always the combination of man, disorder and drug, and how the three get along together that must be assessed in the light of the kind of flying the pilot is likely to undertake before an aeromedical disposition can be made,” he said.

Silberman said that FAA considers prophylactic medications and triptan medications acceptable (although a pilot may not fly for 24 hours after being treated with triptan medications), but FAA would not grant a waiver to an applicant whose migraines were treated with narcotic pain-relievers.

A pilot’s “use of inappropriate medication” was cited by the U.S. National Transportation Safety Board (NTSB) as a factor in a Nov. 26, 1999, accident involving a Beech S35 Bonanza being flown by a pilot with a history of migraines.

The NTSB accident report said that soon after takeoff from an airport in Linden, New Jersey, U.S., on an instrument flight plan in instrument meteorological conditions, the pilot told air traffic control (ATC) that he had a problem with the airplane’s gyroscopic instruments. The report said that during the next two minutes, “heading, altitude and airspeed continued to change, and the pilot did not comply with any ATC instructions.” The airplane struck buildings and terrain in a residential area. The airplane was destroyed; the pilot and his two passengers were killed, two people on the ground received serious injuries, and 25 people on the ground received minor injuries. The report said that the probable cause of the accident was the pilot’s failure to maintain aircraft control. The failure of the horizontal

situation indicator was cited, along with the pilot's use of inappropriate medication, as a factor in the accident.¹⁶

An autopsy revealed butalbital (a barbiturate prescribed to treat migraines) in the pilot's system. The report said that private medical records dating to 1976 showed that the pilot used the barbiturate to control the pain of his migraines. (The most frequent adverse reactions to butalbital, which is a habit-forming drug, are drowsiness and dizziness.) On FAA medical applications, the pilot repeatedly said that he was taking no medication and that he had never suffered from severe headaches or frequent headaches.

Diverse Symptoms Characterize Other Types of Migraines

In addition to migraine with aura and migraine without aura, there are several other types of migraines, including the following:^{17,18}

- Migraine aura without headache (previously called acephalgic migraine) includes symptoms associated with other migraines — but no headache. This migraine can be confused with stroke (blockage or rupture of a blood vessel leading to the brain) or transient ischemic attack (disturbances of brain function caused by a temporary shortage in the supply of blood to the brain). Symptoms, which are believed to be a result of spasms of the arteries in the brain, may be relieved by the same treatments that are administered for other types of migraines. The International Headache Society (IHS) says that patients who have migraine with aura sometimes experience the migraine without a headache, especially as they age. This category accounts for about 5 percent of migraines; and,
- Basilar migraine, which involves a severe headache at the base of the skull, resembles migraine with aura. Symptoms may include blindness, confusion, inability to speak, double vision, a tingling sensation and slight paralysis, and they typically persist about 30 minutes but may continue for several days. Basilar migraines occur most frequently in young adults.

Like migraines, a cluster headache is a type of vascular headache. A cluster headache begins suddenly and lasts for one hour to two hours, sometimes several times a day for six weeks or longer. Typically, the pain — which can become excruciating — is felt on one side of the head, and the patient also has swelling below the eye, a watery eye and nasal congestion on the same side. Consumption of alcoholic beverages is associated with the initiation of many cluster

headaches. The most effective treatment is lithium, a medication generally used in cases of manic depression. Eighty percent of cluster headaches occur in men; the headaches typically begin when the patient is between age 20 and age 40.^{19,20}

Another type of vascular headache is the “jab and jolt” headache, which is characterized by a sudden sharp pain, followed by a brief disruption of vision or speech or some other neurologic problem. Because the disruption lasts less than one minute, treatment typically involves the preventive techniques applied to other types of migraines.²¹

Tension Headaches Felt Most Frequently

Tension-type headaches (sometimes called extra-cranial headaches or muscle-contraction headaches) are the most frequent type of headache, experienced by about 60 percent of the earth's population every year.²² About 90 percent of headaches not related to disease are tension-type headaches. Tension-type headaches are more common in women than in men and typically begin during an individual's teenage years, become most frequent in their 30s and then decrease in frequency. These headaches are a result of muscle tension in the neck, shoulders and head; the muscle tension typically results from emotional stress, an uncomfortable body position, fatigue, dehydration, eyestrain or an illness such as influenza, which causes sore muscles.

Tension-type headaches typically begin in the morning or early afternoon and intensify during the day. The headaches most often are felt on both sides of the head and neck, and sometimes extend over the entire head, the back of the neck and the shoulders.²³

Tension-type headaches most often are treated with massage of the neck, shoulders and head; rest and fluids; or nonprescription analgesics. In some occurrences involving more severe tension-type headaches, stronger analgesics may be prescribed. Tension-type headaches that are caused by emotional stress cannot be relieved by analgesics alone; counseling may be suggested to help resolve the underlying cause of the stress.

Headaches also can occur as side effects of hundreds of types of medications, including analgesics administered to relieve headache pain, and as a result of a variety of diseases, infections and injuries, including the following:^{24,25}

- Sinus infections often are accompanied by headaches that involve pain at the front of the head, usually behind an eye, above the eyebrows, in the upper cheek or in the jaw. The pain typically is worse in the morning and in

About 90 percent of headaches not related to disease are tension-type headaches.

cold, damp weather and during rapid descent from altitude. Quay Snyder, M.D., associate aeromedical adviser to the Air Line Pilots Association, International, said that the sensation during a descent has been described as feeling “like having an ice pick driven through the face.” Sinus headaches typically are treated with decongestants and antibiotics. Pilots who have such “obviously incapacitating” acute sinus headaches should not operate aircraft, Snyder said;

- Glaucoma, a disease in which the pressure within the eyeball increases, may be symptomized by headaches and/or pain in the eye, narrowed peripheral vision and visual disturbances, sometimes including a loss of vision. Treatment may include use of medicated eye drops or other medications to reduce pressure in the eye and to prevent further loss of vision;
- Encephalitis, an inflammation of the brain typically caused by one of several viruses, can result in a headache and other symptoms, including fever, vomiting and stiffness in the neck. The disease interferes with the normal functioning of the brain and causes personality changes, seizures, weakness of some parts of the body, confusion, sleepiness and — if sleepiness progresses — coma. Treatment usually involves antiviral medications;
- Meningitis, an inflammation of the meninges (the covering of the brain and spinal cord), typically is caused by a bacterial infection or viral infection but occasionally is a reaction of the autoimmune system, a side effect of medication or a result of the injection of chemicals into the spine. Symptoms, which may become apparent after a respiratory illness, include a headache, fever, stiffness of the neck, sore throat and vomiting. Severe cases can result in coma and death. Treatment includes the administration of intravenous antibiotics and corticosteroids;
- A brain abscess (pus in the brain) can result from the spreading of an infection in another part of the head or from a head wound. Symptoms include a headache, nausea, vomiting, sleepiness, seizures and personality changes. Treatment involves administration of antibiotics;
- Brain tumors (both malignant tumors and benign tumors) often include headaches as their first symptom. In these occurrences, headaches generally recur frequently or are felt constantly; they often are severe and may be experienced upon awakening. Other early symptoms of a brain tumor include poor coordination, dizziness and double vision. Treatment typically involves surgery;
- Head injuries, including concussions (injuries that result in brief loss of consciousness), cerebral

contusions (concussions that also involve bruising of the brain) and intracranial bleeding (bleeding into spaces between the brain and the skull), typically result in headaches that can persist for days or months, depending on the severity of the injury. Treatments vary — also depending on the severity of the injury — from monitoring the patient to drilling a hole in the skull to drain the excess blood and surgery to stop the bleeding at its source; and,

- Hypertension (high blood pressure) may result in a throbbing sensation in the head and — rarely — in a headache.

Many types of headaches — even mild headaches — can interfere with the performance of flight duties, and some headaches are so severe as to be temporarily disabling. Many treatments can be effective in relieving headache symptoms; nevertheless, in some circumstances, either the headache or the treatment can result in loss of medical certification. ♦

Notes

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11. The U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) is a confidential incident-reporting system. The ASRS Program Overview said, "Pilots, air traffic controllers, flight attendants, mechanics, ground personnel and others involved in aviation operations submit reports to the ASRS when they are involved in, or observe, an incident or situation in which aviation safety was compromised. ... ASRS de-identifies reports before entering them into the incident database. All personal and organizational names are removed. Dates, times, and related information, which could be used to infer an identify, are either generalized or eliminated."

ASRS acknowledges that its data have certain limitations. ASRS *Directline* (December 1998) said, "Reporters to ASRS may introduce biases that result from a greater tendency to report serious events than minor ones; from organizational and geographic influences; and from many other factors. All of these potential influences reduce the confidence that can be attached to statistical findings based on ASRS data. However, the proportions of consistently reported incidents to ASRS, such as altitude deviations, have been remarkably stable over many years. Therefore, users of ASRS may presume that incident reports drawn from a time interval of several or more years will reflect patterns that are broadly representative of the total universe of aviation-safety incidents of that type."
12. NASA ASRS. Report 288545. November 1994.
13. Australian Transport Safety Bureau (ATSB). Occurrence Report no. 199803297.
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Antuñano, Melchor J.; Mohler, Stanley R. "Caffeine Can Pick You Up or Let You Down." *Human Factors & Aviation Medicine* Volume 35 (March–April 1988).

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