



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report **December 20, 2021**

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Medical Officer

A. ACCIDENT: CEN21LA070; Franklin, Arkansas

Date/Time: November 30, 2020; 12:13 p.m. (CST)
Aircraft: Piper PA-38-112, N9879T
Injuries: 2 Fatal
Flight Conducted under Part 91 instructional flight.

B. GROUP IDENTIFICATION

No group was formed for the medical evaluation in this accident.

C. DETAILS OF INVESTIGATION

Purpose

This investigation was performed to evaluate the flight instructor and private pilot for medical conditions, the use of medications/illicit drugs, and the presence of toxins.

Methods

The Federal Aviation Administration (FAA) medical case review and the autopsies and FAA Forensic Sciences Laboratory toxicology¹ reports for the flight instructor and private pilot were reviewed. Other pertinent scientific and regulatory issues were reviewed.

Flight Instructor

FAA Medical Case Review

According to the FAA medical case review, at the time of the accident, the 70-year-old male flight instructor held a second class medical certificate with the limitation that he must have available glasses for near vision. At the time of the most recent exam (10/26/20), the flight instructor was 72 inches tall and weighed 263 pounds. He reported having 3,200 total flight hours and taking no medications. On prior examinations, the pilot reported a heart murmur in 2002 and a history of dizziness in 2014. No other significant medical concerns were identified.

¹ See <https://jag.camii.jccbi.gov/toxicology/> for a complete list of tested-for substances.

Autopsy

According to the autopsy performed by the State Crime Laboratory, Medical Examiner Division, Little Rock, Arkansas, the cause of death in the flight instructor was multiple blunt force injuries and the manner of death was accident. The brain was not available for examination. Other than a mildly enlarged heart (445 grams) and mild to moderate atherosclerosis of the coronary arteries, no significant natural disease was identified by the medical examiner.

Toxicology

Toxicological testing performed by the FAA's Forensic Sciences Laboratory reported the flight instructor's carboxyhemoglobin was 29%. FAA laboratory testing was positive for ethanol at 0.032 grams per hectogram (gm/hg) in the flight instructor's muscle tissue but no ethanol was detected in his liver tissue;² n-butanol was also detected in his muscle tissue but not in his liver tissue. Methamphetamine was detected in the flight instructor's urine at 307 nanograms per milliliter (ng/mL) and amphetamine was detected in his urine at 31 ng/mL; neither methamphetamine nor amphetamine were detected in the flight instructor's cavity blood, liver tissue, and muscle tissue. The non-impairing pain relievers salicylic acid (aspirin) and acetaminophen (commonly marketed as Tylenol) were detected in the flight instructor's urine; acetaminophen was also detected in his cavity blood.³

Carbon monoxide (CO) is an odorless, colorless gas that is a byproduct of combustion, such as from an exhaust system or fire. *Carboxyhemoglobin* is formed when CO binds to hemoglobin, the protein in red blood cells that carries oxygen. The degree of carboxyhemoglobin formation is related to the concentration of CO and the duration of exposure. The binding of CO impairs oxygen transport and use, and results in symptoms of exposure that can be mild and vague to impairing and incapacitating. On room air, the elimination half-life of carbon monoxide is 4 to 6 hours. Carboxyhemoglobin levels above 5% in nonsmokers and above 10% in smokers would suggest exposure to carbon monoxide.⁴

Ethanol is a social drug commonly consumed by drinking beer, wine, or liquor. It acts as a central nervous system depressant; it impairs judgment, psychomotor functioning, and vigilance. Ethanol is water soluble, and after absorption it quickly and uniformly distributes throughout the body's tissues and fluids. The distribution pattern parallels water content and blood supply of the tissue. Ethanol can be produced after death by microbial activity often in conjunction with other alcohols such as n-butanol.⁵

Methamphetamine is a Schedule II controlled substance that is a central nervous system stimulant. It is medically indicated to treat attention deficit hyperactivity disorder (ADHD),

² Grams per hectogram in tissue samples are directly comparable to grams per deciliter in liquid samples.

³ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Acetaminophen. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=2>

Salicylic Acid. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=381>

⁴ Blumenthal, I. 2001. Carbon monoxide poisoning. *Journal of the Royal Society of Medicine*. 94:270-272.

⁵ Kugelberg, FC and AW Jones. 2007. Interpreting results of ethanol analysis in postmortem specimens: a review of the literature. *Forensic Science International* 165(1):10-29.

narcolepsy, and obesity.⁶ Recreationally, methamphetamine is abused for its euphoric effects and to increase alertness and relieve fatigue. Symptoms of recreational methamphetamine use are more intense with inhalation or injection than with oral administration. In the early phase users experience euphoria, excitation, motor restlessness, reduced fatigue or drowsiness, increased alertness, and poor impulse control. As the initial effects wear off, in the late phase, users commonly experience dysphoria, restlessness, agitation, and nervousness. Effects last 4 to 8 hours with some effects lasting up to 12 hours.⁷

Oral doses of methamphetamine prescribed for indicated medical conditions and dosages produce blood concentrations in the range of 20 to 50 ng/mL. Blood concentrations above 200 ng/L indicate recreational use. The timing of peak blood methamphetamine concentrations depends on the method: oral administration at 3 hours, smoking in a few minutes, and injection almost immediately.⁸ Methamphetamine is metabolized to amphetamine. Methamphetamine's elimination half-life is between 6 to 15 hours and amphetamine has a half-life between 10 and 13 hours.⁹

Private Pilot

FAA Medical Case Review

According to the FAA medical case review, at the time of the accident, the 44-year-old male private pilot held a third class medical certificate with the limitation that he must wear corrective lenses for near and distant vision. At the time of the most recent exam (8/3/20), the private pilot was 68 inches tall and weighed 196 pounds. He reported having 144 total flight hours. He reported taking medications losartan and amlodipine to treat his high blood pressure, he also reported having hay fever. No other significant medical concerns were identified.

Autopsy

According to the autopsy performed by the State Crime Laboratory, Medical Examiner Division, Little Rock, Arkansas, the cause of death in the private pilot was multiple blunt force injuries and the manner of death was accident. While the examination was limited by extensive injuries, including the brain being unavailable for examination, no significant natural disease was identified by the medical examiner.

Toxicology

Toxicological testing performed by the FAA's Forensic Sciences Laboratory did not report detection of carboxyhemoglobin in the private pilot's cavity blood; FAA laboratory's reporting limit for carboxyhemoglobin is 10%. The FAA laboratory identified the sedating antihistamine diphenhydramine at 848 ng/mL in the private pilot's cavity blood and in his urine; the sedating

⁶ National Institutes of Health (NIH). U.S. National Library of Medicine (NLM). DailyMed. Updated 2/12/20. Methamphetamine hydrochloride. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=90c02ac6-e5e2-4c97-8c68-81e4e389a195>

⁷ National Highway Traffic Safety Administration (NHTSA). April 2014 (Revised). Drugs and Human Performance Fact Sheets. Methamphetamine (and Amphetamine). <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drughumanperformfs.pdf>

⁸ NHTSA. April 2014. *Ibid*.

⁹ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Methamphetamine. <https://jag.camii.jccbi.gov/toxicology/DrugDetail.asp?did=161>

Amphetamine. <https://jag.camii.jccbi.gov/toxicology/DrugDetail.asp?did=11>

antihistamine cetirizine was detected in his muscle and liver tissues. The non-impairing high blood pressure medications losartan and amlodipine were detected in the private pilot's cavity blood and urine.¹⁰

Diphenhydramine is a sedating antihistamine (commonly marketed as Benadryl) and is available over the counter in many products used to treat colds, allergies, and insomnia. The therapeutic range is 25 to 100 ng/mL and it has a half-life of 3 to 14 hours.¹¹ Diphenhydramine undergoes postmortem distribution and central levels may be two to three times higher than peripheral levels.¹² FAA provides guidance on wait times before flying after using this medication.¹³

Cetirizine is a second-generation antihistamine used to relief hay fever and allergy symptoms. It is available over the counter, commonly marketed as Zyrtec. Although designed to be less sedating, cetirizine does have some sedating properties. The therapeutic range is between 190 and 1,450 ng/mL; the elimination half-life is between 6.5 and 10 hours. FAA provides guidance on wait times before flying after using this medication.^{14,15}

D. SUMMARY OF MEDICAL FINDINGS

Flight instructor

The 70-year-old male flight instructor held a second class medical certificate with the limitation that he must have available glasses for near vision. At the time of the most recent exam (10/26/20), he reported taking no medications. According to the autopsy, the cause of death for the flight instructor was multiple blunt force injuries and the manner of death was accident. The brain was not available for examination; the medical examiner reported the flight instructor had a mildly enlarged heart (445 grams) and mild to moderate atherosclerosis of the coronary arteries.

The flight instructor's toxicology testing detected carboxyhemoglobin at 29%. Toxicology was positive for ethanol at 0.032 gm/hg in the flight instructor's muscle tissue but no ethanol was detected in his liver tissue; n-butanol was also detected in his muscle tissue but not in his liver tissue. Methamphetamine was detected in the flight instructor's urine at 307 ng/mL and amphetamine was detected in his urine at 31 ng/mL.

Private pilot

The 44-year-old male private pilot held a third class medical certificate with the limitation that he must wear corrective lenses for near and distant vision. At the time of the most recent exam

¹⁰ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs.

Losartan. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=151>

Amlodipine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=128>

¹¹ FAA. Updated 1/16/19. Forensic Toxicology's WebDrugs. Diphenhydramine.

<https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=50>.

¹² Han, E, E Kim, H Hong, S Jeong, J Kim, S In, H Chung, and S Lee. 2012. Evaluation of postmortem redistribution phenomena for commonly encountered drugs. *Forensic Sci Int.* 219(1-3):265-271.

¹³ FAA. 11/13/19. What over-the-counter (OTC) medications can I take and still be safe to fly? OK-20-0302 https://www.faa.gov/licenses_certificates/medical_certification/media/OTCMedicationsforPilots.pdf

¹⁴ FAA. Updated 1/16/19. Forensic Toxicology Drug Information. Cetirizine. <https://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=131>

¹⁵ FAA. 11/13/19. What over-the-counter (OTC) medications can I take and still be safe to fly? OK-20-0302 https://www.faa.gov/licenses_certificates/medical_certification/media/OTCMedicationsforPilots.pdf

(8/3/20), he reported taking losartan and amlodipine to treat his high blood pressure. He also reported having hay fever. According to the autopsy, the cause of death for the private pilot was multiple blunt force injuries and the manner of death was accident. While the examination was limited by extensive injuries, including the brain being unavailable for examination, no significant natural disease was identified by the medical examiner.

The private pilot's toxicology testing did not detect carboxyhemoglobin. Toxicology was positive for sedating antihistamine diphenhydramine at 848 ng/mL in the private pilot's cavity blood and in his urine; the sedating antihistamine cetirizine was detected in his muscle and liver tissues. The non-impairing high blood pressure medications losartan and amlodipine were detected in the private pilot's cavity blood and urine.