



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

June 17, 2022

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Medical Officer

A. ACCIDENT INFORMATION

Identification: CEN22FA016

Location: Stroud, Oklahoma

Date: October 18, 2021 (approximately 15:34 local time)

B. GROUP IDENTIFICATION

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

C. DETAILS OF INVESTIGATION

1. Purpose

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

2. Methods

The Federal Aviation Administration (FAA) medical case review and the pilot's autopsy and toxicology reports were reviewed. Selected investigator reports and relevant regulation and medical literature were also reviewed.

3. Findings

a. FAA Medical Case Review

According to the FAA medical case review, the 66-year-old male pilot had no FAA medical certification file.¹

¹ Per [14 Code of Federal Regulations § 61.23\(c\)](#), FAA medical certification is not necessarily required to perform solo flight in a light sport aircraft, provided other requirements are met; however, in this accident, the NTSB investigator in charge determined that the pilot did not meet other requirements for solo flight in a light sport aircraft.

b. Autopsy

The Oklahoma Office of the Chief Medical Examiner performed the pilot's autopsy. According to the autopsy report, the cause of death was blunt force trauma, and the manner of death was accident. The autopsy identified mild atherosclerotic disease of the coronary arteries and cerebral vasculature. The heart muscle was described as concentrically thickened, with a left ventricular wall thickness of 1.8 cm (upper limit of normal is roughly 1.6 cm), an intraventricular septal thickness of 2.2 cm (upper limit of normal is roughly 1.8 cm), and a right ventricular wall thickness of 0.6 cm (upper limit of normal is roughly 0.6 cm). The heart weight of 468 grams was within normal (upper limit roughly 490 grams) for the pilot's body weight of 195 pounds at autopsy.² The heart muscle showed some microscopic changes of heart muscle thickening. The autopsy did not identify other significant natural disease.

c. Toxicology

The Oklahoma Office of the Chief Medical Examiner detected methamphetamine and the methamphetamine metabolite amphetamine in postmortem heart blood from the pilot.

The FAA Forensic Sciences Laboratory also performed toxicological testing of postmortem specimens from the pilot.³ Methamphetamine was identified in urine and at 979 ng/mL in femoral blood. Amphetamine was identified in urine and at 75 ng/mL in femoral blood. Phenylpropanolamine and pseudoephedrine were detected in urine but not in femoral blood. Delta-9-THC (commonly known as THC) was identified in urine and at 2.6 ng/mL in femoral blood. The THC metabolite 11-hydroxy-delta-9-THC was identified in urine but not in femoral blood. The THC metabolite carboxy-delta-9-THC was identified in urine and at 6.1 ng/mL in femoral blood. Tamsulosin was detected in urine and femoral blood.

d. Descriptions of Detected Substances

Methamphetamine is a central nervous system stimulant drug. Amphetamine is a metabolite of methamphetamine, and is also a central nervous system stimulant. Both methamphetamine and amphetamine are available as prescription medications used to treat attention deficit hyperactivity disorder, narcolepsy, and occasionally obesity; each may also be a metabolite of certain other medications. Methamphetamine and amphetamine are Drug Enforcement Administration (DEA) Schedule II controlled substances, with a high potential for abuse and dependence. At low doses used as part of appropriate medical treatment, the drugs may improve reaction time, cognitive function, and fatigue,

² Kitzman DW, Scholz DG, Hagen PT, Ilstrup DM, Edwards WD. Age-related changes in normal human hearts during the first 10 decades of life. Part II (maturity): a quantitative anatomic study of 765 specimens from subjects 20 to 99 years old. *Mayo Clin Proc.* 1988;63(2):137-146. doi:10.1016/s0025-6196(12)64946-5.

³ The FAA Forensic Sciences Laboratory tests specimens for over 1,300 substances including toxins, prescription and over-the-counter medications, and illicit drugs.

but may cause people to make higher-risk choices. At higher doses, the drugs may have a variety of impairing effects on psychomotor function, cognition, and perception. The drugs typically carry warnings that they may impair the ability to engage in potentially hazardous activities such as driving a motor vehicle. Such impairment can result from drug or withdrawal effects.^{4,5,6} Both methamphetamine and amphetamine are considered “do not issue/do not fly” medications by the FAA.⁷

In addition to being used medicinally, methamphetamine and amphetamine are frequently produced illicitly and abused recreationally by ingestion, snorting, smoking, rectal insertion, or injection. Seeking an intense euphoric effect, abusers typically use much higher doses than are used medicinally. Consequently, methamphetamine blood levels can sometimes be used to distinguish abuse from medicinal use. In living people, methamphetamine blood levels above 200 ng/mL generally represent abuse (there is no evidence that levels above this improve task performance), whereas typical levels seen with medicinal use are between 20 ng/mL and 50 ng/mL.⁴

Effects from methamphetamine/amphetamine abuse follow a typical pattern. An abuser may experience early psychological effects including euphoria, excitation, exhilaration, rapid ideas and speech, increased sex drive, restlessness, hallucinations, delusions, psychosis, sleeplessness/reduced tiredness, an increased feeling of alertness, a heightened sense of wellbeing, a feeling of increased physical strength, and poor impulse control. Early physiologic effects may include rapid heart rate, increased blood pressure, increased breathing rate, elevated temperature, dry mouth, abdominal cramps, twitching, dilated pupils, faster reactions, and increased strength. Later, as initial drug effects wear off, an abuser may experience dysphoria, restlessness, agitation, itching, nervousness, paranoia/hypervigilance, irritability, anxiety/nervousness, aggressive/violent impulses, diminished coordination, hallucinations, delusions, scattered thoughts, psychosis, fatigue, and drug craving. Measuring an abuser’s drug level does not help distinguish whether the person is experiencing early versus late effects.⁴

⁴ Couper FJ, Logan BK. Drugs and Human Performance Fact Sheets. National Highway Traffic Safety Administration. DOT HS 809 725. April 2014 (Revised). <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf>. Accessed June 16, 2022.

⁵ National Institutes of Health National Library of Medicine. Methamphetamine hydrochloride. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=f31f580f-1f08-4a0f-b078-0b9e3308f712>. Updated April 15, 2022. Accessed June 16, 2022.

⁶ National Institutes of Health National Library of Medicine. Amphetamine sulfate. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=79b9db39-7cdc-5607-f0ce-ac2a2cfd59d5>. Updated March 1, 2020. Accessed June 16, 2022.

⁷ Federal Aviation Administration. Guide for aviation medical examiners: pharmaceuticals (therapeutic medications) do not issue - do not fly. Federal Aviation Administration website. <https://www.faa.gov/go/dni>. Updated February 19, 2021. Accessed June 16, 2022.

Phenylpropanolamine is a chemical that can be used in illicit drug production to make amphetamine and may be present as an adulterant in a variety of illicit drugs.^{4,8} It is also a minor metabolite of amphetamine. Phenylpropanolamine was previously available in the United States as a nasal decongestant and weight loss ingredient in multiple over-the-counter and prescription products. In 2000, the United States Food and Drug Administration requested that all drug companies discontinue marketing products with phenylpropanolamine for human use, due to a small increased risk of brain bleeding.⁹ Pseudoephedrine, sometimes marketed as Sudafed, is another chemical that may be used as a nasal decongestant; it remains widely available in a variety of cold and allergy medications sold “behind the counter” with no requirement for a prescription.^{10,11} Used appropriately, pseudoephedrine generally is not considered impairing. However, it is one of the most common starting chemicals for illicit methamphetamine production.¹²

Delta-9-THC, commonly known as THC, is the primary psychoactive chemical in marijuana and hashish, derived from the cannabis plant. THC is commonly smoked or ingested recreationally by users seeking mind-altering effects. It may also be used medicinally to treat illness-associated nausea and appetite loss. It is present as an undeclared contaminant in some commercial cannabidiol (CBD) extracts and oils that may be used by a variety of routes for a variety of reasons. In the body, THC is metabolized mainly to the psychoactive chemical 11-hydroxy-delta-9-THC, which is then further metabolized to the non-psychoactive chemical carboxy-delta-9-THC.^{4,13} Psychoactive effects of THC vary depending on the user, dose, and route of administration, and may impair motor coordination, reaction time, decision making, problem solving, and

⁸ Drug Enforcement Administration. Notice - phenylpropanolamine can be used in illicit amphetamine manufacture. Diversion Control Division. https://www.deadiversion.usdoj.gov/chem_prog/advisories/ppa.htm. Updated December 1, 2011. Accessed June 16, 2022.

⁹ Food and Drug Administration. Phenylpropanolamine (PPA) information page. Food and Drug Administration website. <https://www.fda.gov/drugs/information-drug-class/phenylpropanolamine-ppa-information-page>. Updated October 14, 2016. Accessed June 16, 2022.

¹⁰ National Institutes of Health National Library of Medicine. Sudafed Sinus Congestion. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=c05d7e27-6821-468f-b27d-9c0b02a07b0f>. Updated January 18, 2022. Accessed June 16, 2022.

¹¹ Food and Drug Administration. Legal requirements for the sale and purchase of drug products containing pseudoephedrine, ephedrine, and phenylpropanolamine. Food and Drug Administration website. <https://www.fda.gov/drugs/information-drug-class/legal-requirements-sale-and-purchase-drug-products-containing-pseudoephedrine-ephedrine-and-phenylpropanolamine>. Updated November 24, 2017. Accessed June 16, 2022.

¹² Vearrier D, Greenberg MI, Miller SN, Okaneku JT, Haggerty DA. Methamphetamine: history, pathophysiology, adverse health effects, current trends, and hazards associated with the clandestine manufacture of methamphetamine. *Dis Mon*. 2012;58(2):38-89. doi:10.1016/j.disamonth.2011.09.004.

¹³ Berry M. Marijuana and derivatives: what are the aeromedical implications? *FAA Safety Briefing*. May/June 2019. https://www.faa.gov/news/safety_briefing/2019/media/mayjun2019.pdf. Accessed June 16, 2022.

vigilance.^{4,14} THC is a DEA controlled substance, and the FAA considers it unsuitable for flying, regardless of state cannabis laws.^{7,13,15,16}

Tamsulosin, sometimes marketed as Flomax, is a prescription medication commonly used to treat the symptoms of an enlarged prostate.¹⁷ It may also be used in the treatment of kidney stones. It is generally not considered impairing.

D. SUMMARY OF MEDICAL FINDINGS

The 66-year-old male pilot had no FAA medical certification file. The Oklahoma Office of the Chief Medical Examiner performed his autopsy. According to the autopsy report, the cause of death was blunt force trauma, and the manner of death was accident. The autopsy identified mild atherosclerotic disease of the coronary arteries and cerebral vasculature. Concentric heart muscle thickening was present, with a normal heart weight. The autopsy did not identify other significant natural disease. The Office of the Chief Medical Examiner detected methamphetamine and the methamphetamine metabolite amphetamine in heart blood.

The FAA Forensic Sciences Laboratory also performed toxicological testing of postmortem specimens from the pilot. Methamphetamine was identified in urine and at 979 ng/mL in femoral blood. Amphetamine was identified in urine and at 75 ng/mL in femoral blood. Phenylpropanolamine and pseudoephedrine were detected in urine but not in femoral blood. Delta-9-THC (commonly known as THC) was identified in urine and at 2.6 ng/mL in femoral blood. The THC metabolite 11-hydroxy-delta-9-THC was identified in urine but not in femoral blood. The THC metabolite carboxy-delta-9-THC was identified in urine and at 6.1 ng/mL in femoral blood. Tamsulosin was detected in urine and femoral blood.

¹⁴ Compton RP. Marijuana-Impaired Driving: A Report to Congress. National Highway Traffic Safety Administration. DOT HS 812 440. July 2017. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf>. Accessed December 29, 2021.

¹⁵ Federal Aviation Administration. Pilot's Handbook of Aeronautical Knowledge – Addendum A. FAA H 8083 25B (addendum). February 2021. https://www.faa.gov/sites/aa/files/regulations_policies/handbooks_manuals/aviation/phak_addendum_a.pdf. Accessed June 16, 2022.

¹⁶ Federal Aviation Administration. Controlled substances and CBD products. Guide for Aviation Medical Examiners. https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/Controlled_Substances_and_CBD_Products.pdf. Updated May 25, 2022. Accessed June 16, 2022.

¹⁷ National Institutes of Health National Library of Medicine. Flomax. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=6771ad8e-ac92-4aec-b484-5d8350a353f8>. Updated December 16, 2019. Accessed June 16, 2022.