

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



Medical Factual Memorandum for Record

April 12, 2024

A. CASE

NTSB ID: ERA23FA078
Location: Beverly, Massachusetts
Date: December 4, 2022

B. MEDICAL SPECIALIST

Specialist JE Tuttle MD MHA FACS
National Transportation Safety Board
Washington, DC

C. DETAILS

1.0 Description of Review

For purposes of evaluating the pilot for potentially impairing medical conditions and substances, the above Medical Specialist reviewed the following sources of medical information, along with selected relevant regulation, medical literature, and investigator reports.

- Federal Aviation Administration (FAA) medical case review
- Autopsy report- pilot
- Toxicology report - pilot

2.0 Summary of Medical Facts

According to the FAA medical case review, the 66-year-old pilot had never applied for an FAA medical certificate. FAA medical certification is not necessarily required for a pilot to exercise sport pilot privileges provided other requirements are met.¹

The Office of the Chief Medical Examiner (OCME), The Commonwealth of Massachusetts, performed the pilot's autopsy. According to the autopsy report, the pilot's cause of death was blunt force injuries. The manner of death was accident. The autopsy revealed an enlarged heart with thickening of both cardiac ventricles. The left ventricular wall thickness was measured at 1.9 cm (normal is roughly 0.9-1.6 cm), the right ventricular wall at 0.5 cm (normal is roughly 0.2-0.6 cm), and the intraventricular septum at 1.9 cm (normal is roughly 1-1.8 cm). Heart weight was 510g (normal heart weight for a male of the pilot's autopsy body weight of 210 pounds is roughly 290-510 g).² Mild atherosclerosis of the aorta and iliac arteries was also noted. Examination of the brain, lungs, and remainder of the heart revealed no evidence of other significant natural disease.

At the request of the OCME, NMS Labs performed postmortem testing of the pilot's femoral blood.³ Delta-9-THC was also detected in femoral blood at 4.6 ng/mL. 11-hydroxy-delta-9-THC was detected at 1.1 ng/mL. Amlodipine and caffeine were presumptively detected.⁴

The FAA Forensic Sciences Laboratory also performed toxicological testing of postmortem specimens from the pilot.⁵ Delta-9-THC was detected in two femoral blood specimens at 5 ng/mL and 5.5 ng/mL, respectively. Delta-9-THC was also detected in cavity blood at 4.1 ng/mL and in urine at 1.4 ng/mL. 11-hydroxy-THC was detected in urine at 27.1 ng/mL but was not detected in femoral or cavity blood. Carboxy-delta-9-THC was not detected in femoral blood but was detected in cavity

¹ [14 Code of Federal Regulations § 61.23](#).

² Kitman DW, Scholz DG, Hagem 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 Clinic Proceedings*. 1988;63(2):137-146. doi:[https://doi.org/10.1016/s0025-6196\(12\)64946](https://doi.org/10.1016/s0025-6196(12)64946).

³ Information about the blood testing procedure, including tested-for substances, is available on the NMS Labs website at Test Code [8052B](#).

⁴ According to the NMS Laboratory report, these results are due to an initial screening test without confirmatory testing.

⁵ The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including toxins, prescription and over-the-counter medications, and illicit drugs.

blood at 1.9 ng/mL and in urine at 15.2 ng/mL. Amlodipine was detected in femoral blood and urine, as were fexofenadine and its metabolite azacyclonol.

Delta-9-THC is the primary psychoactive chemical in marijuana and hashish, which are products derived from the cannabis plant. Delta-9-THC may be smoked or ingested recreationally by users seeking mind-altering effects. It may also be used medicinally to treat illness-associated nausea, chronic pain, and other symptoms of some chronic diseases.⁶ Dronabinol is a prescription medication that is a pharmacologically created delta-9-THC, often used to treat involuntary weight loss secondary to chronic disease and nausea associated with chemotherapy. Dronabinol usually carries a warning that its use may impair the mental and physical abilities required for the performance of hazardous tasks such as driving a motor vehicle or operating machinery.⁷ The specific psychoactive effects of delta-9-THC vary depending on the user, user history of use, dose consumed, and route of consumption. Effects of delta-9-THC consumption may impair motor coordination, decrease reaction time, impair decision making and problem solving, distort perceptions of reality, and decrease vigilance.⁸ 11-hydroxy-THC is the primary active metabolite of delta-9-THC. Carboxy-delta-9-THC is a non-psychoactive metabolite of delta-9-THC.

When cannabis is smoked, the blood delta-9-THC concentration peaks rapidly, (this peak is delayed and flattened when cannabis is consumed orally). Subsequent decline in the blood delta-9-THC concentration is initially hastened by diffusion of delta-9-THC into fatty tissues. An occasional cannabis user's blood delta-9-THC concentration may fall to a very low or undetectable level within hours after smoking, whereas a frequent cannabis user's blood delta-9-THC concentration may remain detectable for days or weeks of abstinence, as delta-9-THC is sequestered in fatty

⁶ Shah J, Fermo O. Review of systemic and syndromic complications of cannabis use: A review. *Medicine* (Baltimore). 2022;101(49):e32111. doi:10.1097/MD.00000000000032111, 10.1097/MD.00000000000032111.

⁷ National Institute of Health Medical Library. Marinol-dronabinol capsule. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=628f9609-6583-49be-be77-b64cfbc46fd7>. Updated April 8, 2019. Accessed March 22, 2024.

⁸ Testai FD, Gorelick PB, Aparicio HJ, et al. Use of Marijuana: Effect on Brain Health: A Scientific Statement from the American Heart Association. *Stroke*. . 2022;53(4):e176-e187. doi:10.1161/STR.0000000000000396, 10.1161/STR.0000000000000396.

tissues and can redistribute into blood.⁹⁻¹² During this time, as the blood delta-9-THC concentration gradually trends downward due to drug elimination, it can transiently fluctuate upwards due to other physiological factors such as fasting or exercise that mobilize fat stores of delta-9-THC.¹³ Research shows poor and inconsistent correlation between the presence and magnitude of impairment and THC concentrations in blood in living persons.^{13,14} Delta-9-THC is a federally controlled substance, and the FAA considers it unsuitable for flying, regardless of state cannabis laws.^{15,16,17}

Amlodipine is a prescription medication used to control high blood pressure.¹⁸ Caffeine is a central nervous system stimulant that is commonly ingested in coffee, tea, soft drinks, and chocolate. It is also an ingredient in certain anti-drowsiness and headache medications.¹⁹ Fexofenadine is a non-sedating over-the-counter

⁹ Huestis MA. Human cannabinoid pharmacokinetics. *Chem Biodivers*. 2007 Aug;4(8):1770-804. doi: 10.1002/cbdv.200790152.

¹⁰ Bergamaschi MM, Karschner EL, Goodwin RS, et al. Impact of prolonged cannabinoid excretion in chronic daily cannabis smokers' blood on per se drugged driving laws. *Clin Chem*. 2013;59(3):519-526. doi:10.1373/clinchem.2012.195503.

¹¹ Spindle TR, Cone EJ, Schlienz NJ, et al. Acute pharmacokinetic profile of smoked and vaporized cannabis in human blood and oral fluid. *J Anal Toxicol*. 2019;43(4):233-258. doi:10.1093/jat/bky104.

¹² Vandrey R, Herrmann ES, Mitchell JM, et al. Pharmacokinetic profile of oral cannabis in humans: blood and oral fluid disposition and relation to pharmacodynamic outcomes. *J Anal Toxicol*. 2017;41(2):83-99. doi:10.1093/jat/bkx012.

¹³ Peng YW, Desapriya E, Chan H, Brubacher J. Residual blood THC levels in frequent cannabis users after over four hours of abstinence: a systematic review. *Drug Alcohol Depend*. 2020;216:108177. doi:10.1016/j.drugalcdep.2020.108177.

¹⁴ Arkell TR, Spindle TR, Kevin RC, Vandrey R, McGregor IS. The failings of per se limits to detect cannabis-induced driving impairment: Results from a simulated driving study. *Traffic Injury Prevention*. 2021;22(2):102-107. doi:<https://doi.org/10.1080/15389588.2020.1851685>.

¹⁵ 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/ame_guide/pharm/dni_dnf. Updated July 10, 2023. Accessed December 22, 2023.

¹⁶ Federal Aviation Administration. Aeromedical factors. In: *Pilot's Handbook of Aeronautical Knowledge*. FAA-H-8083-25C. Oklahoma City: United States Department of Transportation, Federal Aviation Administration, Airman Testing Standards Branch, AFS-630; 2023. https://www.faa.gov/sites/faa.gov/files/19_phak_ch17.pdf. Accessed December 22, 2023.

¹⁷ 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 December 22, 2023.

¹⁸ National Institute of Health Medical Library. Amlodipine besylate tablet. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=6e9a6c82-9f25-4c71-b09a-929bd5d7b1cf>. Updated January 23, 2008. Accessed April 2, 2024.

¹⁹ National Institutes of Health National Library of Medicine. Caffeine tablet. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=6d9b3926-7198-5e00-e053-2a91aa0a9580>. Updated January 11, 2024. Accessed March 27, 2024.

antihistamine commonly used to treat seasonal allergies.²⁰ Azacylonol is a metabolite of fexofenadine. Amlodipine, caffeine, and fexofenadine are not generally considered impairing.

Submitted by:

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Medical Officer