



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

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Medical Officer

A. ACCIDENT: WPR19FA077; Mt. Hood, Oregon

On January 25, 2019, at 1459 Pacific standard time a Rockwell International 112, N1332J, collided with terrain while maneuvering around the peak of Mount Hood, Oregon. The private pilot, sole occupant, sustained fatal injuries and the airplane was destroyed. The airplane was registered to Auger Air Inc. and operated by the pilot under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91 as a personal flight. The flight departed Portland-Troutdale Airport, Portland, Oregon, about 1530 with a presumed destination of Grove Field Airport, Camas, Washington. Visual meteorological conditions prevailed, and no flight plan had been filed.

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 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 pilot's autopsy, personal medical records, and FAA Forensic Sciences laboratory toxicology¹ reports were reviewed. Other pertinent scientific and regulatory issues were reviewed.

FAA Medical Case Review

According to the FAA initial medical case review, the 63-year-old male pilot held a third class medical certificate with the limitation that he wear corrective lenses. At the time of the most recent exam (4/24/2017), the pilot reported 1,350 total hours of civil flight experience. The pilot reported taking the non-steroidal anti-inflammatory drug (NSAID) ibuprofen and having a

¹ The FAA Forensic Sciences Laboratory tests for more than 1,300 substances including toxins, common prescription and over-the-counter medications as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/>.

history of bilateral knee replacement surgery in 2013. No significant medical issues were identified by the Aviation Medical Examiner.

Autopsy

According to the autopsy performed by the Office of the State Medical Examiner, Clackamas, Oregon, the cause of death was multiple blunt force traumatic injuries and the manner of death was accident. In addition to the blunt force injuries to the head, neck, chest, and extremities, the medical examiner noted the finding of a recent diagnosis of hepatitis B and early cirrhosis of the liver.² No other significant natural disease was identified.

Personal Medical Records

The pilot's medical records from his neurosurgeon were reviewed. On 12/5/17, he had a consultation for lower back pain, right leg pain, and weakness of 5 weeks duration following an acute injury. He reported taking ibuprofen and kratom (mitragynine) and recreational marijuana. An MRI revealed a ruptured disc, and the pilot had a lumbar spine discectomy and laminectomy on 12/8/17. Peri-operatively, he was prescribed the narcotic Norco (hydrocodone/acetaminophen) to control pain.

Medical records were obtained from the pilot's primary care clinic. The patient had been a patient since 2012, however, only records from December 2018 and January 2019 were provided. The pilot saw his primary care physician on 12/11/18 with a complaint of decreased energy level and not sleeping well. He stated the back surgery in 2017 had helped a little. The pilot reported currently using NSAIDs and kratom for sciatica on his right side; he also reported use of cannabis (marijuana). The pilot was prescribed Neurontin (gabapentin) for the back pain. Based on laboratory findings, he was referred to a gastrointestinal (GI) specialist for a colonoscopy and hepatitis C evaluation.

The primary care records also included correspondence and records for the GI visits. The pilot's pre-procedure visit was on 12/28/18. He denied intravenous drug use but stated he had a history of intranasal drug use in the 1970's and 1980's. He reported fatigue and not sleeping well due to sciatica, and reported using NSAIDs, kratom, and, in the last few weeks, opioids due to the back pain. He stated that he was scheduled to have back surgery (fusion) on 2/4/19.³ He was advised to discontinue using kratom and was placed on a proton pump inhibitor (not specified). In early January 2019, he had a CT and ultrasound of his abdomen; no focal abnormalities were identified in his liver. His colonoscopy on 1/21/19 was essentially normal, and a repeat colonoscopy was recommended in 10 years. His endoscopy found some reflux esophagitis, and he was advised to use the proton pump inhibitor omeprazole (commonly marketed as Prilosec) twice a day.

Toxicology

Postmortem toxicological testing by the Oregon State Medical Examiner's Department of State Police Forensic Laboratory of the pilot's chest cavity blood was positive for oxycodone (0.35 milligrams per liter [mg/L]), noroxycodone (0.30 mg/L), and oxymorphone (<0.010 mg/L).

² According to personal medical records, the recent diagnosis was for hepatitis C.

³ In an interview with the pilot's wife, she stated that a pre-operative visit with the neurosurgeon was scheduled for 2/4/2019. Please see docket for interview summary.

Cannabinoids and modafinil were also present in chest cavity blood, but not quantified. Toxicological examination of the pilot's urine detected the presence of oxycodone, noroxycodone, cannabinoids, and modafinil.

FAA toxicology testing of the pilot's cavity blood did not detect delta-9-tetrahydrocannabinol (THC) and its psychoactive metabolite 11-hydroxy-delta-9-THC; the inactive metabolite carboxy-delta-9-THC (THCA) was detected at 3 nanograms per milliliter (ng/mL). In the pilot's urine, THC, 11-hydroxy-delta-9-THC (20.3 ng/mL), and THCA (86.1 ng/mL) were detected. Oxycodone was detected in both chest cavity blood and urine (0.368 mg/L and 7.993 mg/L, respectively). The oxycodone metabolite oxymorphone was detected but not quantified in chest cavity blood and in urine (14.747 mg/L). Mitragynine, also known as kratom, was detected in both chest cavity blood and urine; its active metabolite 7-hydroxymitragynine was only detected in urine. The prescription stimulant modafinil was detected in both chest cavity blood and urine. Metoclopramide, a prescription medication used to treat gastric reflux, was detected in the pilot's urine.

Description of Identified Substances

Marijuana

The marijuana plant (*Cannabis sativa*) contains chemicals called cannabinoids; tetrahydrocannabinol (THC) is the primary psychoactive cannabinoid compound. THC's mood-altering effects include euphoria and relaxation. In addition, marijuana causes alterations in motor behavior, perception, cognition, memory, learning, endocrine function, food intake, and regulation of body temperature. Specific performance effects include decreased ability to concentrate and maintain attention. Impairment in retention time and tracking, subjective sleepiness, distortion of time and distance, vigilance, and loss of coordination in divided attention tasks have been reported. Significant performance impairments are usually observed for at least 1-2 hours following marijuana use, and residual effects have been reported up to 24 hours.⁴

THC is rapidly metabolized but the rate of metabolism is not linear and depends on the means of ingestion (smoking, oil, and edibles), potency of the product, frequency of use, and user characteristics. The primary metabolite, 11-hydroxy-delta-9-THC, is equally psychoactive, but is rapidly metabolized to the non-psychoactive metabolite THCA. THC is fat soluble, so is stored in fatty tissues and can be released back into the blood long after consumption. So, while the psychoactive effects may last a few hours, THC can be detected in the blood for days or weeks. Very little THC is excreted in urine. Instead, THCA can be found in urine days to weeks after the last use of the drug. Thus, both blood and urine test results do not necessarily reflect recent use and cannot be used to prove that the user was under the influence of the drug at the time of testing.⁵

⁴ National Highway Traffic Safety Administration. April 2014. Drugs and Human Performance Fact Sheets. Cannabis/Marijuana. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/809725-drugshumanperformfs.pdf>

⁵ Compton, R. July 2017. Marijuana-Impaired Driving - A Report to Congress. (DOT HS 812 440). Washington, DC: National Highway Traffic Safety Administration. <https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf>

Oxycodone

Oxycodone is a synthetic opiate to treat severe pain. Oxycodone is marketed under various names including Oxycontin. Among other precautions, the medication carries the warning that use may impair mental or physical ability to drive a car or operate machinery. Its usage has a high risk of addiction, abuse, and misuse. Therapeutic levels are typically between 0.013 to 0.099 mg/L⁶ for infrequent users, but tolerance, where increasing doses are needed to achieve the same effect, is seen in more frequent and chronic users. One study found that the range of oxycodone concentrations in 37 postmortem cases where oxycodone was an incidental finding was 0.017 to 1.300 mg/L.⁷

The primary metabolite of oxycodone is noroxycodone, which is a considerably weaker analgesic. Oxymorphone is also a metabolite of oxycodone; while usually produced in lesser amounts, it also has analgesic properties. Oxycodone and its metabolites are excreted in the urine. The elimination half life of oxycodone is about 4 hours.⁸

Mitragynine

Mitragynine and 7-hydroxymitragynine are the primary psychoactive compounds found in the leaves of the southeast Asian kratom tree. It has stimulant effects at low doses, such as increased alertness, physical energy, and talkativeness, and sedative effects at high doses. It is considered a drug of concern by the U.S. Drug Enforcement Administration (DEA) and the U.S. Food and Drug Administration (FDA) has asked the DEA to attempt to place the drug into Schedule 1 drugs with high potential for abuse and no medical value similar to heroin, the FDA has not approved mitragynine for any medical use.^{9,10}

Metoclopramide

Metoclopramide is a prescription medication for short-term gastroesophageal reflux treatment for those who do not respond to conventional therapy. Side effects include restlessness, drowsiness, and fatigue. Metoclopramide can impair physical and mental abilities needed to drive a motor vehicle or operate machinery. Additive sedative effects occur when taken concurrently with alcohol, sedatives, or narcotics.¹¹

⁶ Federal Aviation Administration. Updated 1/16/19. Forensic Toxicology's WebDrugs. Oxycodone. <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=94>.

⁷ Thompson, JG, S Vanderwerf, J Seningen, M Carr, J Kloss, and FS Apple. 2008. Free oxycodone concentrations in 67 postmortem cases from the Hennepin County medical examiner's office. *J. Anal. Tox.* 32:673-679.

⁸ National Institutes of Health. U.S. National Library of Medicine. DailyMed. Oxycodone hydrochloride. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=5df92fed-6194-4905-9ef2-9eed0d2e8086#i4i_info_patients_id_d1dbd46f-ca81-41c1-b8bb-ec0048eebd5a. Updated 10/31/19.

⁹ U.S. Drug Enforcement Administration. 2017. Drugs of Abuse. A DEA Resource Guide. Kratom. https://www.dea.gov/sites/default/files/sites/getsmartaboutdrugs.com/files/publications/DoA_2017Ed_Updated_6.16_17.pdf#page=84

¹⁰ U.S. Department of Health and Human Services, Office of the Secretary. October 17, 2017 letter to Drug Enforcement Administration recommending permanent control of mitragynine and 7-hydroxymitragynine in Schedule I. Available at: <https://www.documentcloud.org/documents/5031552-HHS-kratom-letter.html>

¹¹ National Institutes of Health. U.S. National Library of Medicine. DailyMed. Metoclopramide hydrochloride tablet. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=494e8008-8b3a-4aa4-8b7d-05869b861100> Updated 4/2/19.

Modafinil

Modafinil is a central nervous stimulant prescribed to improve wakefulness in patients with excessive sleepiness from narcolepsy, obstructive sleep apnea, or shift work disorder. The drug produces psychoactive and euphoric effects, and alterations in mood, perception, and thinking. Patients should be cautioned about driving a motor vehicle or operating machinery when using the medication.¹²

D. SUMMARY OF MEDICAL FINDINGS

At the time of the accident, the 63-year-old male pilot held a third class medical certificate with a limitation that he wear corrective lenses. He reported to FAA that he used ibuprofen and had a history of bilateral knee surgery. Personal medical records show that he had experienced a back injury requiring surgery in December 2017. At medical office visits in December 2018, he complained of fatigue, poor sleep, and continued back pain. He reported use of ibuprofen, kratom and marijuana. The pilot had a recent diagnosis of hepatitis C and a diagnosis of esophageal reflux.

According to the autopsy, the cause of death was multiple blunt force traumatic injuries and the manner of death was accident. In addition to the blunt force injuries to the head, neck, chest, and extremities, the medical examiner noted the finding of a recent diagnosis of hepatitis and early cirrhosis of the liver. No other significant natural disease was identified.

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¹² National Institutes of Health. U.S. National Library of Medicine. DailyMed. Modafinil tablet. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=5bc33938-2717-471b-b066-c6c67317d4e0> Updated 12/31/16.