



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

MEDICAL FACTUAL REPORT

March 15, 2019

Nicholas Webster, MD, MPH
Medical Officer

A. ACCIDENT: WPR18FA063 - Ogden, Utah

On December 29, 2017, about 1441 mountain standard time, a Cessna 172M, N4395R, impacted water in the northern portion of the Great Salt Lake. The commercial instructor pilot and a private pilot rated passenger were fatally injured. The airplane was registered to the Hill Flying Club Inc., and operated by a private individual as a 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed for the local flight and no flight plan had been filed. The flight originated from the Ogden-Hinckley Airport (OGD), Ogden, Utah, about 1420.

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 pilots for medical conditions, the use of medications/illicit drugs, and the presence of toxins.

Methods

The FAA medical case review, medical certification records, the instructor pilot's personal medical records, autopsy reports, and FAA Bioaeronautical Sciences Research Laboratory toxicology reports were reviewed. Other pertinent scientific and regulatory issues were reviewed.

Instructor Pilot - Right Seat

FAA Medical Case Review and Medical Certification Files

According to the FAA records, at the time of his most recent FAA medical certification exam dated July 11, 2016, the 71-year-old male pilot was 75 inches tall, weighed 227 pounds, and reported he had accrued 5,587 total flight hours. The pilot reported he used the anti-inflammatory medication oxaprozin to treat joint pain and the acid reducing medication

omeprazole for stomach protection.^{1,2} These medications are generally considered not to be impairing. The aviation medical examiner found no abnormalities on examination and issued the pilot a third class medical certificate with a limitation that he must have available glasses for near vision.

Personal Medical Records

Primary care medical records for visits between February 2015 and December 26, 2017 were reviewed. The pilot was receiving ongoing testosterone replacement injections, had low back pain in 2015 and left knee arthritis in 2017 both treated with steroid injections and no documented evidence of recurrence. His active medications as of December 2017 included the antihistamine nasal spray azelastine;³ the acid reducing medication omeprazole; the anti-inflammatory medication oxaprozin; the cholesterol medication fenofibric acid;⁴ the nasal steroid spray fluticasone;⁵ the prostate medication terazosin;⁶ and the oral antifungal medication terbinafine.⁷ The nasal spray azelastine carries a warning of sedation while the pilot's other prescribed medications are generally not considered to be sedating or impairing.

One ophthalmology examination record from a visit in December 2014 was reviewed. It documented the pilot had no significant visual pathology and his vision corrected to 20/20 with glasses.

The records contained no documentation of treatment for depression, pain, or recent opioid prescriptions.

Autopsy

The Utah Department of Health Office of the Medical Examiner's autopsy documented the cause of death was drowning and the manner was accident. The pilot had an enlarged heart with left biventricular hypertrophy; his heart weighed 590 grams, the average for a man his weight is 399 grams (range 302-526 grams).⁸ No other significant natural disease was identified.

¹ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Oxaprozin. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=d9b0ca6c-4c53-4f6e-918b-02a8c472a194>

² National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Omeprazole. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ab74d236-7745-4b27-8c7b-f49d5009d8af> Accessed 02/28/2019

³ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Azelastine. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ccb6046c-3c10-42c6-aa22-23192c21a5fa> Accessed 02/28/2019

⁴ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Fenofibric acid. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bbf3e782-d163-49c8-0e81-4eeabef48190> Accessed 02/28/2019

⁵ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Fluticasone. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=672ee961-c33f-45bd-bd85-e65d26986df2>

⁶ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Terazosin. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=43e92495-2cf2-46dd-a80c-f0c3c88c7b73>

⁷ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Terbinafine. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=7c6c1494-fb92-4442-bcff-764b77397495>

⁸ 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 Clinic Proc.*, 1988. 63(2): p. 137-46.

Toxicology

Utah Public Health Laboratories forensic toxicology testing of inferior vena cava blood conducted as part of the autopsy was negative for alcohol. Testing detected the sedating opioid pain medications hydrocodone at 0.080 µg/ml and morphine at 0.064 µg/ml.⁹

FAA Bioaeronautical Sciences Research Laboratory toxicology testing detected ethanol at 23 mg/dl in urine but none in blood; carbon monoxide was not detected in blood.^{10,11} Testing detected the following potentially impairing drugs in inferior venacava blood: gabapentin at 3.897 µg/ml, hydrocodone at 0.082 µg/ml; its active metabolites dihydrocodeine at 0.024 µg/ml; and morphine at 0.078 µg/ml.¹² The following medications, which are generally considered not to be impairing, were also detected: the pain and fever medication acetaminophen;¹³ the nasal decongestant oxymetazoline;¹⁴ the prostate treatments tamsulosin and terazosin;^{15,16} and the antidepressant venlafaxine at 0.054 µg/ml in blood and its metabolite desmethylvenlafaxine in blood.¹⁷

Description of Identified Psychoactive Substances

Gabapentin is an anti-seizure medication also used to treat chronic pain and is marketed under various names including Neurontin. It is a central nervous system depressant and may cause somnolence, dizziness, ataxia, nystagmus, and fatigue. It carries the warning “Prescribers and patients should be aware that patients' ability to assess their own driving competence, as well as their ability to assess the degree of somnolence caused by gabapentin, can be imperfect.”¹⁸ It is not a scheduled substance but is only available by prescription. The accepted half-life of gabapentin is from 5 to 9 hours and the therapeutic range is from about 2 to 30 µg/ml.^{19,20}

⁹ Blood was tested for drugs of abuse and prescription drugs; gabapentin and venlafaxine were identified on screening, but the lab does not confirm these drugs.

¹⁰ Ethanol is the intoxicant commonly found in beer, wine, and liquor. It acts as a central nervous system depressant. Ethanol was found only in urine but not blood. Impairment determinations are based on blood levels not urine.

¹¹ The FAA Bioaeronautical Sciences Research laboratory tests for more than 1300 substances including toxins, common prescription and over-the-counter medications as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0> for a complete listing.

¹² See WPR18FA063 - Ogden, Utah Accident Docket - Toxicology Report for detailed findings.

¹³ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2018. Bethesda, MD. Acetaminophen. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=e4cfbe12-d712-4ca6-8400-14eeec2eca019> Accessed 12/17/2018

¹⁴ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2019. Bethesda, MD. Oxymetazoline. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=06bfb6a3-fede-45c1-af95-33d4609db1ff> Accessed 12/17/2018

¹⁵ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2018. Bethesda, MD. Tamsulosin. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=339c3b57-a339-4578-bfd7-46b25d911ff6#section-11.1> Accessed 12/17/2018

¹⁶ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2018. Bethesda, MD. Terazosin. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=d156295e-43aa-4456-9c2c-b6a367c385de> Accessed 12/17/2018

¹⁷ National Institutes of Health. US National Library of Medicine. *DailyMed*, 2017. EFFEXOR XR- venlafaxine hydrochloride. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=53c3e7ac-1852-4d70-d2b6-4fca819acf26&audience=consumer> Accessed 12/17/2018

¹⁸ National Institute of Health, National Library of Medicine (U.S.). *DailyMed* 2018. Bethesda, MD. Neurontin - gabapentin. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ee9ad9ed-6d9f-4ee1-9d7f-cfad438df388> Accessed 12/17/2018

¹⁹ Baselt RC Disposition of Toxic Drugs and Chemicals in Man, 10th Edition. Copyright 2014, Biomedical Publications, Seal Beach, California. Gabapentin, Page 925.

²⁰ Schulz M. et al. Therapeutic and toxic blood concentrations of nearly 1,000 drugs and other xenobiotics. Schulz et al. *Critical Care* 2012, 16: R136

Hydrocodone is an opioid pain medication available by prescription as a Schedule II controlled substance. Commonly available in combination with acetaminophen (commonly called Tylenol), tablets may also carry names such as Norco, Lorcet, and Vicodin. Hydrocodone carries the warnings: “exposes users to the risks of addiction, abuse, and misuse” and “profound sedation, respiratory depression, coma, and death may result from the concomitant use of hydrocodone ... with benzodiazepines or other CNS depressants (e.g., non-benzodiazepine sedatives/hypnotics, anxiolytics, tranquilizers, muscle relaxants, general anesthetics, antipsychotics, other opioids, alcohol).”²¹ The range of blood levels where hydrocodone is considered to have therapeutic psychoactive effects is between 0.01 and 0.05 µg/ml.²²

Morphine is a powerful opioid pain medication available as an injection, tablet, or capsule, identified as a Schedule II controlled substance. Ranges for therapeutic levels are typically determined by giving novice users one or two doses and measuring their blood levels. For morphine, such ranges are 0.010 to 0.100 µg/ml.²³ Toxic levels of opioids are typically associated with symptoms such as coma and respiratory depression; the information may come from cases of acute intentional or unintentional overdose. With regular opioid use, brain physiology changes, leading to tolerance for both the desired analgesic effects and the sedative effects and increasing dosing as a result; chronic users may need the drug to feel and act “normally.”²⁴ This means a chronic user may appear to function normally at levels that would be toxic or even fatal to a first-time user.

Morphine, hydrocodone, and gabapentin are all central nervous system depressants and have a combined additive effect on toxic drug effects including sedation, slowed or difficult breathing and death.²⁵

Venlafaxine is a prescription antidepressant, anti-anxiety, anti-panic disorder medication marketed as Effexor. As with many anti-depressant medications, it carries a black box warning of clinical worsening of depression and emergence of suicidal thought and behaviors after starting medication. The medication is general not considered impairing at therapeutic levels which are considered to range from 0.071 to 0.232 µg/ml. It is metabolized in the liver and metabolites include norvenlafaxine and a o-desmethylvenlafaxine; its half-life ranges from 30 to 120 hours.²⁶

²¹ National Institutes of Health. US National Library of Medicine. DailyMed. Hydrocodone Bitartrate and Acetaminophen. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=fa32969f-7210-47ec-bbd1-f62bea8989a7> Accessed 9/5/2018.

²² Federal Aviation Administration. Civil Aerospace Medical Institute. Toxicology Drug Information: Hydrocodone. <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=73> Accessed 9/6/2018.

²³ Federal Aviation Administration. CAMI Toxicology Drug Information. <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=176> Accessed 8/2/2018.

²⁴ Kosten TR, George TP. The Neurobiology of Opioid Dependence: Implications for Treatment. Science & Practice Perspectives. 2002;1(1):13-20.

²⁵ Lexicomp Online® 2019, Lexi-Comp Online™ Interaction Analysis, Hudson, Ohio: Lexi-Comp, Inc.; Accessed 02/28/2019

²⁶ Baselt RC Disposition of Toxic Drugs and Chemicals in Man, 10th Edition. Venlafaxine. Pages 2099-2102. Copyright 2014, Biomedical Publications, Seal Beach, California.

Pilot Receiving Instruction - Left Seat

FAA Medical Case Review and Medical Certification File

According to the FAA records, at the time of his most recent FAA medical certification exam dated April 10, 2014 the 74-year-old male pilot was 70 inches tall and weighed 169 pounds. He had reported he had accrued 315 total flight hours. The evaluation did not identify any potentially impairing medications or medical conditions and the pilot was issued a third class medical certificate with a limitation that he must have available glasses for near vision.

Personal Medical Records

No personal medical records were obtained for the pilot receiving instruction.

Autopsy

The Utah Department of Health Office of the Medical Examiner's autopsy documented the cause of death was drowning and the manner was accident. The pilot was 71 inches tall and weighed 172 pounds. He had an enlarged heart with no atherosclerotic disease and normal heart muscle; his heart weighed 470 grams, the average for a man his weight is 345 grams (range 261-455 grams).²⁷ No other significant natural disease was identified.

Toxicology

Utah Public Health Laboratories forensic toxicology testing of inferior vena cava blood conducted as part of the autopsy was negative for drugs of abuse, prescription drugs and alcohol.²⁸ FAA Bioaeronautical Sciences Research Laboratory toxicology testing did not detect ethanol or carbon monoxide. The non-impairing, benign prostatic hypertrophy treatment medication, tamsulosin was detected in urine and blood.²⁹

D. SUMMARY OF MEDICAL FINDINGS

The 71-year-old male instructor pilot was issued a third class medical certificate on July 11, 2016 with a limitation that he must have available glasses for near vision. He reported the use of the anti-inflammatory medication oxaprozin to treat joint pain and the acid reducing medication omeprazole for stomach protection. These medications are generally considered not to be impairing.

Personal medical records through December 2017 documented the instructor pilot was receiving ongoing testosterone replacement and had low back pain in 2015 and left knee arthritis in 2017 that were both treated with steroid injections and no documented evidence of recurrence. His prescription medications included: the antihistamine nasal spray azelastine; the acid reducing medication omeprazole; the anti-inflammatory medication oxaprozin; the cholesterol medication fenofibric acid; the nasal steroid spray fluticasone; the prostate medication terazosin; and the oral antifungal medication terbinafine. The nasal spray azelastine carries a warning of sedation while the pilot's other prescribed medications are generally not considered to be sedating or impairing. The records contained no documentation of treatment for depression or recent opioid prescriptions.

²⁷ 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 Clinic Proc., 1988. 63(2): p. 137-46.

²⁸ Blood was tested for alcohols, drugs of abuse, prescription drugs. The complete list of tested for drugs and testing cutoffs were not provided in the report.

²⁹ The FAA Bioaeronautical Sciences Research laboratory tests for more than 1300 substances including toxins, common prescription and over-the-counter medications as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0> for a complete listing.

The Utah Department of Health Office of the Medical Examiner's autopsy documented the instructor pilot's cause of death was drowning and the manner was accident. He had an enlarged heart with left biventricular hypertrophy. No other significant natural disease was identified.

Utah Public Health Laboratories forensic toxicology testing of the instructor pilot's inferior vena cava blood was negative for alcohol. Testing detected the sedating opioid pain medications hydrocodone at 0.080 µg/ml and morphine at 0.064 µg/ml.

FAA Bioaeronautical Sciences Research Laboratory toxicology testing of the instructor pilot's blood was negative for ethanol and carbon monoxide. However, 23 mg/dl of ethanol was detected in the urine. The following potentially impairing medications were detected in inferior vena cava blood: the anti-seizure / nerve pain medication gabapentin at 3.897 µg/ml; the opioid pain medication hydrocodone at 0.082 µg/ml and its active metabolites dihydrocodeine at 0.024 µg/ml; and the opioid pain medication morphine at 0.078 µg/ml. Morphine, hydrocodone, and gabapentin are all central nervous system and have a combined additive effect on toxic drug effects including sedation, slowed or difficult breathing and deaths. Additionally, the following drugs that are generally considered not to be impairing at therapeutic levels were detected: the pain and fever medication acetaminophen; the nasal decongestant oxymetazoline; the prostate treatments tamsulosin and terazosin; and the antidepressant venlafaxine and its metabolite desmethylvenlafaxine.

The 74-year-old male pilot receiving instruction was issued a third-class medical certificate on April 10, 2014 with a limitation that he must have available glasses for near vision. He reported no significant medical conditions and no impairing medications.

The Utah Department of Health Office of the Medical Examiner's autopsy documented the pilot receiving instruction's cause of death was drowning and the manner was accident. He was 71 inches tall and weighed 172 pounds. He had an enlarged heart with no atherosclerotic disease and normal heart muscle. No other significant natural disease was identified.

Utah Public Health Laboratories forensic toxicology testing of the pilot receiving instruction's inferior vena cava blood was negative for drugs of abuse, prescription drugs and alcohol. FAA Bioaeronautical Sciences Research Laboratory toxicology testing did not detect ethanol or carbon monoxide. Testing detected the non-impairing, benign prostatic hypertrophy treatment medication, tamsulosin.