



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

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Medical Officer

A. ACCIDENT: ERA18FA187; Williamsburg, Virginia

On July 8, 2018, about 1633 eastern daylight time, a Robinson R44-II, N616HS, was destroyed when it impacted a condominium building in Williamsburg, Virginia. The commercial pilot on-board the helicopter and one resident in the building were fatally injured. Day visual meteorological conditions prevailed at the time, and no flight plan was filed for the flight, which originated from Williamsburg-Jamestown Airport (JGG), Williamsburg, Virginia about 1630 and was destined for Stafford Regional Airport (RMN), Stafford, Virginia. The helicopter was privately owned and operated by the commercial pilot under the provisions of Title 14 Code of Federal Regulations Part 91.

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 FAA medical case review, pilot's FAA medical certification records, toxicology data from FAA Forensic Sciences, autopsy report, and personal medical records were reviewed. Other pertinent scientific and regulatory issues were examined.

FAA Medical Case Review and FAA Medical Certification File

According to the FAA files, the 85-year old male pilot had reported 5,633 total hours of civil flight experience as of his last aviation medical exam, dated 9/1/2016. At that time, he was 65 inches tall and weighed 156 pounds. The pilot reported taking propranolol to treat essential tremors. Propranolol is a prescription medication often used to treat blood pressure that can also improve

tremulousness. It is not generally considered impairing.¹ The pilot also reported surgical placement of a deep brain stimulator (DBS) in January 2016 to treat his tremors and Parkinson's disease. The pilot reported no concerns. The pilot was not issued a Second Class Medical Certificate, and the aviation medical examiner (AME) deferred his medical application to FAA for issuance.

Subsequently, medical information was submitted to the FAA by the pilot's treating neurologists. A 9/30/2016 note from the airman's consulting neurologist noted the insertion of a deep brain stimulator for tremors and reported that signs of dementia and cognitive decline were noted on neuropsychological testing, so they were starting medication to treat cognitive deficits. This neurologist specifically recommended that "he (the airman) no longer fly." The FAA denied the medical application on 5/30/2017, for early dementia and use of a disqualifying medication, rivastigmine. The pilot's new neurologist provided a note to the FAA on 1/19/2018 which stated, "he no longer has a diagnosis of mild dementia, and now had a diagnosis of mild cognitive impairment." On 4/12/2018, the FAA sustained the previous denial after the airman requested reconsideration due to his "aeromedically significant cognitive impairment and Parkinson's disease."

The pilot's previous issuance of a second class medical certificate was in July 2015. The only restriction listed was that he "must have available glasses for near vision." The aviation medical examiner commented that the pilot used propranolol, "For essential tremor, No exacerbation of tremor." The pilot had previous aviation medical applications annually dating back to 2001 and in 1999, 1986, 1972, and 1965. The first reported use of propranolol appeared in the 2008 application.

Toxicology

Toxicology testing performed by the laboratory at FAA's Forensic Sciences identified 0.032 grams per deciliter (gm/dL) of ethanol in kidney tissue and no drugs or ethanol in muscle.² Ethanol is primarily a social drug with a powerful central nervous system depressant. After absorption, ethanol is quickly distributed throughout the body's tissues and fluids fairly uniformly. The distribution pattern parallels the water content and blood supply of each organ. Ethanol may also be produced in the body after death by microbial activity.³ Additionally, specimens were specifically retested for the presence of rivastigmine; this medication was not found.

¹ National Institutes of Health. US National Library of Medicine. DailyMed. Propranolol. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=a4edba76-29b8-41fb-bf0b-d4633abba003> Accessed 4/25/2019.

² 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.camii.jccbi.gov/toxicology/default.asp?offset=0>.

³ Federal Aviation Administration. Forensic Toxicology Drug Information. Ethanol. <http://jag.camii.jccbi.gov/toxicology/DrugDetail.asp?did=60> Accessed 03/02/2015

Autopsy

According to the autopsy performed by the Medical Examiner for Williamsburg, VA), the cause of death was blunt force trauma and the manner of death was accident. The autopsy was limited due to the extent of injury, the brain and heart were not identified. External examination identified wires consistent with the pilots known DBS implant.

Personal Medical Records

The pilot's personal medical records were received for the pilot's neurology visits. These records covered the period from 5/20/15 to 3/6/17. In the 5/20/15 neurosurgeon note, the pilot reported difficulty with writing, eating, and fine motor movements. He was taking propranolol 10 mg six times a day with only 20% improvement of the tremor. On physical exam, he had a marked action tremor in the upper extremities. The pilot was referred for consideration of DBS to treat his essential tremor. According to the notes, the pilot first noticed the tremor in 1988 and was diagnosed in 1990. On the pilot's visit to the neurologist on 8/20/2015, it was noted that in addition to upper extremity tremors, there was bilateral mild slowing of hand movements and leg agility. The pilot was started on carbidopa-levodopa for parkinsonism symptoms. On his follow-up visit on 9/29/2015, some improvement was noted; however subjectively the pilot did not notice improvement in motor function. Propanol had been reduced to four times a day by his primary care doctor because of bradycardia (slow heart rate).

Pre-operative neuropsychological testing performed on 9/23/2015 for the DBS surgery revealed variable working memory and reduced simple attention span. There was no evidence of cortical dementia, and the pilot's cognitive deficits were best characterized as mild cognitive impairment. The pilot's dopamine transporter scan in October 2015 found dopamine deficiency consistent with a parkinsonian syndrome. The pilot had left DBS (Medtronic Activa PC) implantation surgery on 1/21/2016. The surgery was without complications, with the last post-operative visit to the neurosurgeon on 5/16/2016.

DBS involves implanting a neurostimulator as therapy for several conditions, including essential tremor, to reduce symptoms that cannot be adequately controlled with medication and where there is significant functional disability. The device is typically implanted subcutaneously near the clavicle, connected to an extension and leads which are implanted in the brain. A controlled electrical pulse is delivered to targeted areas of the brain. Warning, precautions, and adverse events⁴ described by the manufacturer Medtronic include "Sources of electromagnetic interference (EMI) may cause device damage or patient injury; Theft detectors and security screening devices may cause stimulation to switch ON or OFF; Loss of coordination in activities such as swimming may occur; Adverse events related to the therapy, device, or procedure can include new or

⁴ Medtronic, Brief Statement: Movement Disorders, Deep Brain Stimulation, accessed 3/29/19.
<https://www.medtronic.com/us-en/healthcare-professionals/therapies-procedures/neurological/deep-brain-stimulation/indications-safety-warnings/brief-statement-movement-disorders.html>

exacerbation of neurological symptoms (including vision disorders, speech and swallowing disorders, motor coordination and balance disorders, sensory disturbances, cognitive impairment, and sleep disorders), and psychiatric and behavioral disorders (including psychosis and abnormal thinking).”

The first programming of the DBS by the neurologist occurred on 2/16/2016. A good response was found with one of the four contacts that reduced right hand tremor with only mild side effects (“head fuzziness”). The pilot was instructed how he could slowly adjust the amplitude. The pilot reported that he felt his balance was not as good as years ago. On the 3/16/2016 visit, it was noted that his right action tremor was 50% better, and they worsened in the afternoon (associated with fatigue). He reported being able to eat peas with spoon and being able to drink better. Amplitude was increased to a level that reduced tremor without light headedness; the pilot was instructed to gradually increase stimulation but to look for side effects of imbalance and lightheadedness. On the 5/3/2016 visit, the device was further adjusted to provide reduction in right tremor with less side effects. The pilot was instructed how to taper off the carbidopa-levodopa. The pilot reported slightly decreased cognitive and memory function, but 95% improvement of his right-hand tremor. At the 6/15/16 follow-up, the pilot was self-increasing the DBS, so no additional programming was performed. The pilot was sent for evaluation for possible right DBS placement to counter his left upper extremity tremor.

The pilot’s repeat post-DBS neuropsychological testing on 8/17/2016 found progression in cognitive deficits at the level of mild cortical dementia. Cognitive decline can be a side effect of DBS. The neuropsychologist noted that the patient “did not endorse any items suggestive of concern about cognitive functioning. This is consistent with observations during the testing session that he was not insightful about his cognitive issues.” The testing found worsening of psychomotor speed and attention. At the follow-up neurologist visit on 9/16/2016, the neurologist discussed his concerns about the pilot flying and driving, discussed that the right implantation DBS surgery was not advised, and started the pilot on rivastigmine to treat his dementia. In the requested letter to the FAA, the neurologist recommended the pilot did not fly because of his mild dementia. On 10/31/2016 visit, no adjustments were made to amplitude; it was noted that the pilot had self-decreased the amplitude due to stumbling. The final note from this neurologist was provided for a visit on 3/6/2017, an increased dose of rivastigmine was prescribed. The pilot had self-adjusted the DBS amplitude slightly. Flying concerns were discussed.

The pilot started seeing a new neurologist on 6/30/2017. The pilot’s chief complaints were “I want return to flight status”, tremors, and memory difficulties. He stated his last flight was on 8/1/2016. On physical exam, some difficulty with recent and remote memory was reported as well as an inability to perform a

tandem gait.⁵ A left-hand resting tremor was noted. This neurologist concurred with the previous one that the pilot should not fly and should only drive short distances because he was concerned about the pilot's reaction time and judgment. The neurologist ordered physical therapy. At the 8/1/2017 visit, the pilot reported having had six motor vehicle accidents through the spring of this year and having constant daily left-hand tremors and imbalance. Left greater than right resting tremors were noted.

Neuropsychological testing on 8/4/2017 by a different neuropsychologist showed improvement from previous testing with evidence of mild cognitive impairment instead of dementia. However, the pilot had impaired measures of simple attention and visual scanning and tracking speed, and mild, relative difficulty with sustained attention. Given his difficulties, the neuropsychologist raised concerns about safety if the pilot continued to fly. At the 9/8/2017 neurologist visit, the pilot reported that he had stopped using the rivastigmine patch, because the letter from the FAA stated "that as long as he used the patch, he would not be able to receive a flying license."

The pilot underwent an occupational therapy driver rehab evaluation on 10/27/17 because his driver's license had been suspended for having multiple motor vehicle accidents during the first half of 2017. The driver rehab evaluation noted below normal dynamic vision and vision information processing. The pilot demonstrated deficits in both sustained and divided attention. A driving restriction of "drive within a 15-mile radius from home" was recommended. Subsequently, at the pilot's neurologist visit on 10/31/17, the pilot reported failing his department of motor vehicle (DMV) driver's test and mentioned he was going to try a different DMV office to get his driver's license reinstated. At the 1/19/2018 visit, the pilot told the neurologist that his driving license had been reissued.

The last office visit to the neurologist prior to the accident was on 5/4/2018. The pilot reported his disappointment with the recent FAA denial (April 2018) to issue his medical certificate. Last flight was still reported as 8/1/2016. He stated he had had an appointment with the neurosurgeon who will see him in the next 6 months to a year to replace his DBS battery. The pilot reported continued bilateral hand tremors with mild imbalance. Propanolol was the only medication reported. On physical exam, slowed movements, decreased eyeblinks, a mild wide-based gait, and left greater than right hand resting tremors were noted.

D. SUMMARY OF MEDICAL FINDINGS

The 85-year-old male pilot had a long history of progressive upper extremity tremor that he had reported to the FAA. His application for a medical certificate was deferred to the FAA on 9/1/2016 for evaluation of his neurosurgical interventions for tremor. As recently

⁵ Tandem gait test is performed by having the patient attempt to walk in a straight line with the heel of one foot touching the toe of the other with each step. Tandem gait tests are used to help identify several sensory and motor system abnormalities.

as April 2018, FAA denied issuing a medical certificate due to the pilot's cognitive impairment and Parkinson's disease.

According to the autopsy performed by the Medical Examiner for Williamsburg, VA, the cause of death was blunt force trauma and the manner of death was accident. The examination was limited by the severity of injury. A deep brain stimulator was identified.

According to personal medical records, the pilot had been diagnosed with a parkinsonian syndrome in April 2015. Treatment with carbidopa-levodopa resulted in some improvement of his symptoms. He had a deep brain stimulator implanted that improved his right-hand tremor. Neuropsychological evaluations performed pre- (September 2015) and post- (August 2016) surgery determined increased cognitive decline to mild cortical dementia; cognitive decline can be a side-effect of the surgery. The neuropsychological testing in August 2016 determined that the pilot was not insightful about his cognitive issues and that he had worsening of psychomotor speed and attention. The pilot was started on rivastigmine to treat the dementia.

After terminating care with the first neurologist in June 2017, the new neurologist ordered a follow-up neuropsychological evaluation in August 2017. This evaluation found improvement from previous testing with evidence of mild cognitive impairment instead of dementia. Also noted was that the pilot had impaired measures of simple attention and visual scanning and tracking speed, and mild, relative difficulty with sustained attention. The pilot reported self-discontinuing rivastigmine in September 2017 because the letter from the FAA stated “that as long as he used the patch, he would not be able to receive a flying license.”

At numerous physician office visits, the pilot had reported difficulty with tremors, balance, and memory. He mentioned increasing tremors as the day progressed. He described having multiple motor vehicle accidents and having his driving license suspended. He continually expressed his desire to get his flying certificate back. All of neurologists and neuropsychologists involved with the pilot's care or evaluation expressed concern about the safety of having the pilot fly and there was concern about attention, reaction time, and judgment. A driver rehab evaluation performed in October 2017 noted below normal dynamic vision and vision information processing. The pilot demonstrated deficits in both sustained and divided attention. A driving restriction of “drive within a 15-mile radius from home” was recommended.

Toxicology testing identified 0.032 gm/dL ethanol in kidney tissue but no drugs, or ethanol, in muscle.