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GENERAL AVIATION PILOTS OVER 70 YEARS OLD

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Abstract

Background: Currently it is not rare that general aviation pilots in the U.S. continue to fly beyond the age of 70, even to their 80s and 90s. Pilots have regular examinations according to protocols, which do not specify special or additional requirements for pilots over 70 years of age. Additionally, the third class medical reforms passed by the U.S. Senate on 15 July 2016 could potentially result in even less stringent medical certification requirements for general aviation pilots.

Methods: Accident rates, medical parameters, autopsy findings and toxicological findings from the US National Transportation Safety Board (NTSB) general aviation (GA) accident database were analyzed to assess potential risk factors with accident outcomes.

Results: During 2003-2012 there were 114 (113 men, 1 woman) general aviation fatal accidents involving pilots aged 70 to 92 years. A combination of three or more drugs were found in 13 (13%) of deceased pilots (13%). The most frequent drugs were first generation antihistamines, and antidepressants represented the next highest proportion of possible performance-affecting medications.

Conclusion: This study indicates that there are critical medical factors that may contribute to fatal accidents among elderly pilots. Polypharmacy use should be taken into consideration especially during periodical health examinations and fatal aviation investigations involving elderly pilots.

Accident/Fatal/Drug/Polypharmacy/Antidepressants

Introduction

Currently it is not rare that general aviation pilots in the U.S. continue to fly beyond the age of 70, even to their 80s and 90s. The number of pilots over 70 years of age with an active pilot certificate in the U.S. have been increasing particularly during the last decade with about 29 000 pilots in 2011 and 32 000 pilots in 2015.[8,9] In developed countries, about 10% of the general population is 60 years or older, and the fastest growing portion of the population is people over 80 years of age. It is recognized that adults 60 or 70 years of age are generally healthier than their counterparts were in the past.

Pilots have regular examinations according to protocols which do not specify special or additional requirements for pilots over 70 years of age.[10] Originally, periodical medications had their roots in military aviation medicine. Thereafter, they have been modified for the general pilot population but not necessarily for an elderly pilot population. In addition, the recent medical reform in U.S. could exacerbate this situation as some pilots (who have had FAA medical license within 10 years prior to 15 July 2016) will not need to see an aeromedical examiner (AME) any more, and there will be a greater need for a proper guideline for GPs (rather than just a checklist) when they see these pilots once every 4 years.[2]

Periodic pilot medical examinations are typically performed by physicians who do not themselves participate in the pilot's routine health care, and thus they may not be fully informed of the medical history of the pilot. Self-reported medical history declarations are employed currently to identify clinical problems, but disclosure often is inaccurate or absent.[11]

In commercial aviation flying was limited until recently to 60 years of age. This rule has been modified; for example, in the European Union a commercial pilot can continue his/her career up to 65 years if the other pilot in the cockpit is not over 60 years of age.[7] The potential health problems associated with aging are well considered among professional pilots by strict medical evaluations and health requirements. In fact, active pilots are healthier than the general population but also in the population of active pilots there is a larger variation in medical fitness of pilots with age.[16]

In the aging general aviation population, the situation is different. Current data suggest that general aviation pilots over 60 years old, despite usually having more experience, were more likely to be involved in a fatal accident compared with younger pilots.[3] Our research question was whether fatal individual accident cases are affected by age-related health status and/or medication use. These aspects are important because there is lack of studies on pilots over 70 years of age, and studies associating flight performance and medical causes in fatal accidents involving senior citizens are lacking.

A pilot may loose partial or complete ability to perform optimally during flight because of medical causes. This loss may occur gradually or suddenly. The absolute or partial inability to perform normal duties related to flight is known as incapacitation. Most studies have focused on sudden incapacitation. Pre-existing medical conditions, which may have a progressive and even subtle effect in causing potentially deterioration in performance and a fatal accident among elderly pilots over 70 years require further evaluation.

Methods

This study was exploratory in nature and the design was a cross-sectional study on fatal aircraft accidents among older pilots. All fatal aircraft accident reports involving pilots 70 years and older in general aviation operations between 2003-2012 in the USA were identified using the NTSB database.[14] Data on age, gender, event year, cause of accident, autopsy, toxicological studies, and medical history were collected. For comparison, similar data was collected on pilots aged 60-to-63 years old during the same period. The comparison group represented the oldest pilot group in related studies.[12,4]

The cause of accident was categorized to technical, human (errors in performance, skill, perception), medical (disease, drugs), or undetermined. Distributions are reported as numbers and proportions. Proportion ratios (PR) and their 95% confidence intervals (CI) were calculated using the standard formula for risk ratios. The proportion ratio is the ratio of the proportions among older vs. younger pilots. If the 95% confidence interval does not contain the null value (1.0), the respective proportion ratio is considered statistically significant.

Results

During 2003-2012 there were 114 (113 men, 1 woman) fatal aviation accidents involving pilots aged 70 to 92 years and 85 fatal accidents (all male) involving pilots aged 60-to-63 years. Autopsies were carried out in 103 (91%) older and in 79 (93%) younger pilots (PR

0.98, 95% CI 0.90-1.07) (Table I). Similarly, toxicology studies were carried out in 101 (89%) older and in 79 (93%) younger pilots (PR 0.95, 95% CI 0.87-1.04). According to the accident reports, the probable causes of accidents were related to pilots' performance in 64 (58%), to technical failures in 29 (26%) and to medical issues in 7 (6%) among the older pilots, and in 64 (75%), 14 (17%) and 2 (2%), respectively, among the younger pilots.

In autopsy reports, a disease that may have had potentially a causal association with the accident was found in 20 (19%) older and in 5 (6%) younger pilots (PR 3.04, 95% CI 1.19-7.74). In toxicological studies, drugs which may impair performance and were not allowed for pilots when flying were detected in 27 (27%) older and in 19 (24%) younger pilots (PR 1.11, 95% CI 0.67-1.85). A combination of three or more drugs were found in 13 (13%) older and in 3 (4%) younger pilots (PR 3.39, 95% CI 1.00-11.49). The most frequent drugs were first generation antihistamines, which were detected in 17 (17%) older and in 6 (8%) younger pilots (PR 2.22, 95% CI 0.92-5.36). Antidepressants represented the next highest proportion of possible performance-affecting medications and were detected in 7 (7%) older and in 3 (4%) younger pilots (PR 1.83, 95% CI 0.49-6.83). [Table I here]

Discussion

The regulations related to periodic medical examinations for pilots in general aviation do not provide any special requirements for those pilots who continue flying after 70 years of age. Fatal aviation accidents involving pilots 70 years and older have increased in recent years in U.S. Both contemporaneous and coincidental disease and medications appear to be associated with increased risk for these fatalities. Deficiencies in performance related to medicine use

may be contributing factors in accidents even if the cannot be identified in an autopsy. Examples, which belong to this group, are errors of perception and judgment as well as errors in reaction. Traditionally medical causative or contributing factors and operational causes have been separate. As an example, Chaplin[5] postulated that in single-pilot operations, the risk of operational error is greater than the medical incapacitation risk. Pre-existing medical conditions may be of importance, even if they only cause partial incapacitation or performance impairment, as is suggested by the results of this study.

The most frequently used medications among pilots over 70 years or age (17% of cases) were first generation antihistamines, and these drugs can exert hypnotic effects and impair flight performance.[15] It is likely that in the elderly pilot population antihistamine is used as a sleep medication because of its sedative effect. The problem is that these antihistamines reduce rapid eye movement (REM)-sleep and impair performance. This problem in the elderly pilot population is underreported or underestimated. In an earlier study, between 4% and 11% of fatal aviation accidents within a 16-year period (1990-2005) reported first-generation antihistamines in the pilot autopsy reports but no conclusions were derived from this information.[17]

The second most frequently used medications (7%) were antidepressants among pilots over 70 years of age. It is noteworthy that pilots were forbidden to use antidepressants at the time of the present study period.[18] The problem with this hidden use of antidepressants is three-fold. First, in these cases the disease for which these drugs were administered is unknown. Second, there are available antidepressants, which may be used with aviation, and some which are not acceptable in aviation because of their side effects. Third, these cases were examined solely by an aero-medical examiner. The use of antidepressants among these elderly pilots was noteworthy. From a diagnostic point of view, it is important to consider that major depression often shows atypical symptoms

among the elderly. In addition, elderly people are at increased risk of adverse outcomes when they consume antidepressants. Road traffic accidents have been shown to increase with after recent use of antidepressants.[13]

In the present study 12% of older pilots consumed three or more drugs at the time of the accident. Among the elderly, comorbidities may increase the risk of drug interactions. The use of multiple medications also has been shown to be associated with land vehicle crashes.[1] Furthermore, the studies of road traffic accidents have shown that age related cognitive impairment has been an important exacerbating factor contributing to those accidents.[6]

Our analysis found that in several fatal accidents older pilots received medical certification to fly despite medications or diseases possibly affecting flight performance. These pilots should have been prohibited from flying, and civil aviation safety authorities should have been notified. Flight safety profiles of older pilots could be improved by incorporating a pilot's general practitioner, who performs periodic medical examinations on the pilot. It would be advisable to require a statement of current medical treatment from the attending general practitioners regarding health status and medications. This deficiency explains why there are not many screening tests carried out in medical periodical examinations. Nonetheless, the situation could be improved regarding elderly pilots.

Because older individuals are physiologically and mentally heterogeneous, it is challenging to target medical restrictions to those pilots who need them. This may be a reason for lack of additional screening requirements. This challenge could be exacerbated after the recent third class medical

reform in U.S.[2] This study provides evidence that there are critical medical factors to consider regarding fatal accidents among elderly pilots.

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Conflict of interest

Dr. Strandberg reports personal fees from several companies (incl. Amgen, AstraZeneca, Pfizer, Orion, Bayer, Boehringer-Ingelheim, Nutricia, Abbott). Minor amount of stock in Orion Pharma, outside the submitted work; and President, European Union Geriatric Medicine Society (EUGMS), non-profit position.

Dr. Alpo Vuorio has received lecture honoraria from Aegerion Ltd and consultation fees from Raisio Group and Pfizer

Table

Table I.

Comparison of accident investigation data revealed from NTSB reports in general aviation operations between 2003-2012 in the USA of 60 to 63 years old pilots to 70 years and older pilots

	Age group (years)			
	60-63		70-92	
Characteristic	**n**	**(%)**	**n**	**(%)**
N	85		114	
Event year				
2003-2004	1	(1)	1	(1)
2005-2006	8	(9)	9	(8)
2007-2008	23	(27)	38	(33)
2009-2010	25	(29)	34	(30)
2011-2012	28	(33)	32	(28)
Examinations				
Autopsy	79	(93)	104	(91)
Toxicology	79	(93)	101	(89)
Cause in NTSB report				
Technical	14	(16)	29	(25)
Human	64	(75)	64	(56)
Medical	2	(2)	7	(6)
Undetermined	5	(6)	11	(10)
Medical findings				
Disease*	5	(6)	20	(19)
Medicine				
Any	19	(24)	27	(27)
>=3*	3	(4)	13	(13)
Antihistamine	6	(8)	17	(17)
Antidepressant	3	(4)	7	(7)

NTSB = National Transport Safety Board; * = significant difference