Migraine History and Recurrence in Military Pilot Applicants

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BACKGROUND: Migraine is a common condition with features that can adversely impact aviation activities. The diagnosis of migraine is often compatible with civil aviation training, but is much more concerning for military pilot applicants. A history of migraine headache traditionally medically excluded potential military pilot applicants due to unpredictability of occurrence and potential for operational distraction or incapacitation. Medical standards and policy applications have been quite variable, ranging from total exclusion for even one headache occurrence to as low as a 1-yr migraine-free period before consideration. In many instances, policy application has been subjective and not based on objective evidence. This presents a challenge to waiver authorities and also potentially sends a mixed message to command authorities. There is essentially no current literature evidence applicable to the aviation population on migraine occurrence risk.
METHODS: This study reviewed 71 U.S. Air Force pilot applicants who were diagnosed with migraine and had been granted waivers

- to assess any predictive factors for migraine recurrence and its aeromedical impact.
- **RESULTS:** Only three applicants had recurrence after waiver was granted, with two of these occurring within 2 yr of their last reported migraine event, and all recurrences noted within 3 yr.
- **Discussion:** Data indicated favorable risk with suitable migraine-free observation before military pilot training, which could be incorporated into aeromedical standards and policies.
- **KEYWORDS:** migraine, pilots, aircrew selection.

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igraine headaches are a commonly occurring condition with significant aeromedical implications. Migraine is estimated as the third most prevalent and sixth most disabling illness worldwide, most common between ages 25-55, with more than 90% of sufferers unable to function normally or work during attacks, resulting in U.S. estimated annual costs of up to \$36 billion in heathcare and lost productivity.¹⁰ Not surprisingly, migraine is commonly encountered in the aerospace population.¹² There is wide variability in clinical features within the spectrum of migraine, ranging from rarely occurring, mild or self-limited episodes, to frequent, incapacitating events. Migraine aura symptoms also range from nonsignificant or annoying to functionally impairing, depending on the location and amount of vision affected; involvement of central vision or large portions of the visual field are especially concerning for aircrew. Diagnostic criteria for migraine have been developed and published.⁶ However, these criteria are not always followed by clinicians and the diagnosis of migraine may be incorrectly applied. The future recurrence risk of migraine is

imprecisely predictable, as recurrence or change in headache pattern can occur in previously stable migraine sufferers. If migraines are infrequent and can be managed with aeromedically compatible treatment, aircrew can often be safely recommended for aviation duties. Migraines with associated 'complicated' neurological symptoms such as speech, motor, or cognitive changes, even with infrequent occurrences, are generally considered incompatible with aviation duties because of resulting functional impairment. Recognition and attention to modifiable triggering factors may mitigate future occurrence risk and allow safe aeromedical waiver recommendation.⁹ In military pilot applicants, due to imprecise future occurrence

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risk, strict medical standards, significant training investment, and service commitment incurred, the diagnosis of migraine may preclude medical clearance.

Military aviation medical standards are generally much stricter than those for civil aviation, reflecting the potential for high performance single-place aircraft operation stressors and other factors more unique to military service. In the U.S. Air Force (USAF), manned aircraft pilot applicants must be medically suitable and qualified for service in any aircraft, with no official avenue to be selectively assigned to a particular aircraft type prior to entering training. For this reason, USAF pilot applicants have the most stringent medical standards. Medical standards for fully trained USAF pilots offer more flexibility to return to flying status. All USAF aviators receive annual physical assessments that query for and evaluate any medical conditions for aeromedical risks that could adversely affect continued aviation service. Training investments and work commitments for civil aviation are generally less substantial than for military aviation, which allows civil and commercial pilot applicants a greater possibility of medical clearance. While USAF aeromedical standards are clear that a history of migraine is disqualifying for aviation service, standards application has historically been quite variable, ranging from permanent disqualification of pilot applicants with even a remote history of migraine to granting of aeromedical waivers after a subjectively suitable symptom-free period. Evidence-based data on migraine recurrence risk would facilitate clearer and more consistent application of military aeromedical standards in pilot applicants.

METHODS

38

This study protocol was reviewed and approved under Exempt status by the 711th Human Performance Wing Institutional Review Board (FWR20190069). The Aeromedical Consultation Service Neuropsychiatry Branch database⁸ and the USAF Aeromedical Information Waiver Tracking System (AIMWTS) application were queried for USAF pilot applicants with a history of migraine and who had been granted an aeromedical waiver. Waiver authorities based their disposition decision on USAF aeromedical standards, clinical information, and recommendations from review authorities. Search criteria included text and International Classification of Diseases codes for migraine and common subtypes such as migraine with aura, and ocular or complicated migraine. Information from 2002 through November 2018 was obtained. After identifying pilot applicants with a history of migraine and who had been granted aeromedical waivers, the Armed Forces Health Longitudinal Technology Application and Health Artifact and Image Management System application were queried to obtain additional information on their longitudinal clinical course. Information from these sources were then collected into an MS Access® database. Descriptive univariate and

survival analysis was performed using IBM SPSS Statistics Version 23.

RESULTS

A total of 71 USAF pilot applicants were identified from 2002-2018 who had a diagnosis of migraine and had been granted aeromedical waiver before starting training. Migraine diagnoses were not always made by neurologists or other specialists. Of the study cohort, 69 were pilot applicants and 2 were navigator applicants with essentially equivalent medical standards. The applicant population consisted of 63 men and 8 women with mean age at waiver disposition of 24.2 yr (95% CI 23.4, 25.0), with a range of 21 to 38. The average age at the time of last migraine was 17.4 yr (95% CI of 16.2, 18.7). The mean time from last reported migraine to waiver disposition was 6.8 yr (95% CI 5.88, 7.76). Mean observation time after waiver granting was 6.9 yr (95% CI 5.58, 8.13). For those who attended Undergraduate Pilot Training (UPT), 32/36 (88.9%) successfully completed this training. Migraine recurrence was noted in 3/71 applicants (4.23%, 2 men, 1 woman) after waiver was granted. Two of these three recurrences were within 2 yr of the last reported migraine, and the third occurred 3 yr following the last reported migraine occurrence.

Only one of the three applicants with recurrence after waiver completed UPT. The only woman with recurrence after waiver had previously been treated with topirimate for frequent incapacitating post-traumatic migraines. She was able to discontinue prescription medication and mitigate headaches with trigger avoidance and nonprescription medication. The waiver summary indicated 'they have improved drastically' and based on this information she was granted a waiver about 6 mo afterwards. She then had migraine exacerbation with frequent occurrences about 1 yr after her waiver was granted while she was awaiting pilot training. She was restarted on topirimate for prevention and was then medically disqualified by the waiver authority before attending UPT. Waiver notes at this time indicated that at best her headaches had been occurring 'about once a month or less, which had not been accurately reflected in her original waiver notes. The second member with migraine recurrence after waiver, a man, had a history of dietary-triggered childhood migraine and an 11-yr headache-free period at the time his waiver was granted. He was dismissed from UPT due to motion sickness and his migraine recurrence was noted after he left UPT, 3 yr from the time his waiver was granted. The third applicant with recurrence, a man, had his migraine recurrence while attending UPT about 2 yr after his waiver was granted. He was medically disqualified and then reapplied for pilot training 2 yr later, and was granted an indefinite waiver by the waiver authority at that time. He then successfully completed UPT. In over 14 yr following his waiver, he had medical visits for migraine at 2 and 7 yr after his waiver was granted. Airsickness complaints during UPT were identified in 9/71 (12.68%) of applicants, but only 1 applicant was dismissed from training for this reason.

DISCUSSION

Migraine is a common condition with a wide range of clinical manifestations and individual variability.³ Aeromedically relevant clinical manifestations include occurrence frequency, pain severity, and accompanying symptoms. Accompanying symptoms and headache pain can adversely affect safe aircraft operations.^{11,13} Headache frequency is a major factor influencing suitability for aviation service. Migraine recurrence risk is also an important factor in determining aeromedical disposition, particularly in untrained military and commercial pilot applicants who incur a substantial training investment and (at least in the military) an expected service commitment. While migraine by definition and classification implies a recurrent process,⁶ there is remarkably little information on recurrence risks, particularly in adults. Information from follow-up studies on pediatric migraine is a useful starting point, as military pilot applicants are generally in early adulthood and have a history of childhood migraine. One study of 300 children with migraine, of which 108 were followed for 12 yr, noted 10-yr remission in 37/108 (34%), but no remissions after age 18.² A seminal Norwegian study of 9000 children with migraine reported 40-yr follow-up in 73 children, noting 23% were migraine-free before age 25, boys significantly more often than girls.¹ A more recent study of 181 children with migraine with a 10-yr follow-up indicated 88% followed a 'favorable' clinical course, defined as not requiring preventive medication, with the best relative risk noted for migraine onset between ages 6-10; results were not delineated by gender.⁷ Our study data indicated a low risk of operationally significant recurrence (4.23%) in pilot applicants with a history of migraine, with two of three recurrences noted within 2 yr of waiver granting and all recurrences noted within 3 yr.

Important questions for consideration when developing aeromedical standards for migraine include the minimum migraine-free observation period for safe recommendation of waiver/certification, and whether there are any predictive factors for migraine remission or recurrence that could be considered. The U.S. Federal Aviation Administration (FAA) does not delineate between trained pilots and applicants with migraine, and allows aviation medical examiner-issued certification for up to one migraine occurrence per month if certain other conditions are fulfilled.⁵ There is no specified observation period in current FAA or USAF policy guidance, but historical USAF Instruction guidance allowed for consideration of aeromedical waiver following 1 yr of symptom-free observation.¹⁴ This recommendation was primarily opinion-based and not validated by evidence, and was removed from subsequent USAF policy guidance. Unfortunately, the lack of a well-defined recommended migraine-free observation period, while consistent with available clinical evidence, has led to variable and inconsistent medical standard application. Results of this study indicated a favorable future recurrence risk with at least 2 yr of migraine-free observation prior to waiver consideration. One potential policy clarification for military pilot applicants would be to incorporate a 2-3 yr migraine-free observation period

with no complicated neurological symptoms, exam abnormalities, or clinically relevant imaging findings before consideration of aeromedical waiver.

This study had several limitations. The number of members in our study was relatively small, reflecting inclusion of only USAF pilot applicants. USAF pilot applicant characteristics might differ from those of other military and civilian aviation services. As migraine is primarily a subjective diagnosis, underreporting is possible and, if present, could skew study results. The study cohort consisted primarily of young adult men. This distribution could account for the favorable recurrence rate, as historical studies of childhood migraine indicated a more favorable outcome in boys, and the incidence of migraine lessens in males after puberty. The paucity of women reflected USAF pilot applicant demographics, but may not accurately reflect the effect of higher migraine incidence in this segment and did not provide any information on specific concerns in this population.⁴ Military pilot applicants typically do not have any significant medical conditions, since these generally preclude qualification for military service. This may not be reflective of civil aviators and, therefore, the study results may be incompletely applicable to this population. The study group had an average 6.9-yr migraine-free period prior to aeromedical waiver, which may not be reflective of nonmilitary pilot applicants.

Overall, study results indicated a favorable outcome for pilot applicants with a history of migraine who were migraine-free for at least 2 yr before aeromedical waiver consideration. Results also noted the previously observed association between migraine and motion sickness. Further collaborative studies with other military services and civil aviation agencies are indicated to include more women in the observation cohort, additionally clarify the aeromedically reasonable migrainefree observation period, incorporate longer-term follow-up, and delineate any potential predictive factors for migraine recurrence.

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