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Permanent Grounding and Flying Restrictions in Canadian Forces Pilots: A 10-Year Review

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VAN LEUSDEN AJ, PRENDERGAST PR, GRAY GW. *Permanent grounding and flying restrictions in Canadian Forces pilots: a 10-year review.* Aviat. Space Environ. Med. 1991; 62:513-6.

The medical files were reviewed of all Canadian Forces pilots in whom a permanent change in flying category was recommended during the period 1 January 1978 through 31 December 1987. In an average pilot population of 2,697 pilots, 60 permanent groundings (2.2 per thousand) and 209 permanent operational flying restrictions (7.7 per thousand) were assigned among 258 pilots. Coronary heart disease was the most common cause for permanent grounding (25% of total), followed by neurologic disorders including migraine (22% of total), other cardiovascular disorders, including mitral valve prolapse and arrhythmias (17%), and psychiatric problems (12%). Refractive errors were the most common basis for an operational flying restriction (25%), followed by orthopedic disorders (17%), mainly low back pain. The relevance of these observations is discussed in terms of medical selection and surveillance procedures.

THE CENTRAL MEDICAL BOARD (CMB) of the Canadian Forces (CF), located at the Defence and Civil Institute of Environmental Medicine (DCIEM), is the aeromedical agency responsible for assessing experienced CF aircrew with medical problems. Appropriate recommendations regarding operational flying restrictions or grounding are made by a panel of senior Flight Surgeons based on these assessments. Assessments may be carried out either through a review of medical documents, or by personal interview and examination at CMB. Aircrew are generally referred through Air Command or CF Europe to CMB, and CMB recommendations are forwarded to the Surgeon General, Director of Medical Treatment Services who has the final review

and approval authority. CMB files on pilots were reviewed for the 10-year period 1978-1987 to determine the incidence of various medical causes for grounding or permanent operational flying restrictions; in the latter case, the flying restriction assigned was also determined.

METHODS

We retrieved and reviewed the records of all Canadian Forces pilots who developed a medical problem requiring a permanent operational flying restriction or grounding and resulting in a permanent change in flying category during the period 1 January 1978 through 31 Dec 1987. The primary diagnosis initiating the permanent category change and the recommended operational flying restrictions were extracted. The medical problems were grouped as follows:

- a. refractive errors
- b. hypertension
- c. coronary heart disease
- d. other disorders of the heart and blood vessels
- e. orthopaedic disorders
- f. neurological disorders
- g. psychiatric disorders
- h. other

The Canadian Forces medical category system is flexible and allows the assignment of virtually any appropriate operational flying restriction. Each service member's medical category includes an Air Factor which designates their operational flying status. For pilots, an A1 Air Factor indicates an unrestricted flying category. Other Air Factors apply to aircrew other than pilot (A2 or A4), or non-aircrew personnel who are medically fit to fly as passengers (A5). An A3 Air Factor designates any aircrew with an operational flying restriction; this must be qualified by the actual restriction imposed. Aircrew who are medically unfit for aircrew duties are

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awarded an A7 category. Category changes may be permanent or temporary, in which case the Air Factor is so annotated. For example, an A3(T6), "Restricted to fly with another pilot qualified on type," indicates a 6-month restricted category as defined.

RESULTS

Over the 10-year period, 60 permanent groundings and 209 permanent operational flying restrictions were assigned among 258 pilots (a flying restriction preceded permanent grounding in some cases). The average annual pilot population during this period was 2,697 (range 2,507–2,901, S.D. 132.8) so the annual rate of grounding averaged 2.2 per thousand, while the annual rate of a medically-required operational flying restriction averaged 7.7 per thousand. In about one third of cases, a permanent category assignment was preceded by a temporary one.

Table I lists the distribution per diagnostic group of restrictions (A3) or groundings (A7) awarded. Coronary heart disease was the most common medical cause for permanent grounding, while refractive error was the most common cause for an operational flying restriction.

A more detailed breakdown of the main diagnostic groups with at least three cases per diagnosis is given in Table II.

Migraine accounted for almost half (16/34) of the neurological cases. Demyelinating disease, tumours, and seizures were other less common causes.

Among cardiovascular disorders other than coronary disease and hypertension, mitral valve prolapse and arrhythmias were the most common. Two pilots were grounded for complications of mitral valve prolapse (MVP), one for a left frontal lobe embolism, the other for sustained supraventricular arrhythmias. Those restricted had either mild mitral regurgitation or arrhythmias demonstrated under +Gz. The average age per diagnostic group is given in Fig. 1. The mean age of all pilots at the time of permanent category change was 39.2 years, ranging from 34.8 for neurological problems to 45.9 for coronary artery disease. There was no significant age difference between pilots receiving a flying restriction or grounding. Of the pilot population in this

TABLE I. DISTRIBUTION OF PILOTS GROUNDED (A7) OR RESTRICTED (A3) PER DIAGNOSTIC GROUP.

Diagnostic Group	A7		A3	
	No.	%	No.	%
Coronary artery disease	15	25.0	1*	0.5
Neurologic disorders	13	22.0	21	10.0
Other cardiovascular disease	10	17.0	15	7.0
Psychiatric disorders	7	12.0	11	5.0
Refractive errors	2	3.0	53	25.0
Orthopaedic disorders	2	3.0	35	17.0
Hypertension	2	3.0	30	14.0
Other	9	15.0	43	21.0
Total	60		209	

* Later permanently grounded.

TABLE II. DIAGNOSTIC GROUPS WITH THREE OR MORE CASES FOR GROUNDED (A7) AND RESTRICTED (A3) PILOTS.

Diagnostic Groups	A7	A3
Neurologic disorders		
Migraine/vascular headaches	5	11
Cardiovascular disorders		
Mitral valve prolapse	2	6
Syncope	1	2
Arrhythmias	3	3
Orthopaedic disorders		
Disc disease		14
Low back strain		6
Spondylolisthesis		4
Trauma	1	2
Other disorders		
Ulcerative colitis		3
Sarcoidosis		3**
Urolithiasis	1	5
Asthma	1	6

** Later returned to unrestricted flying.

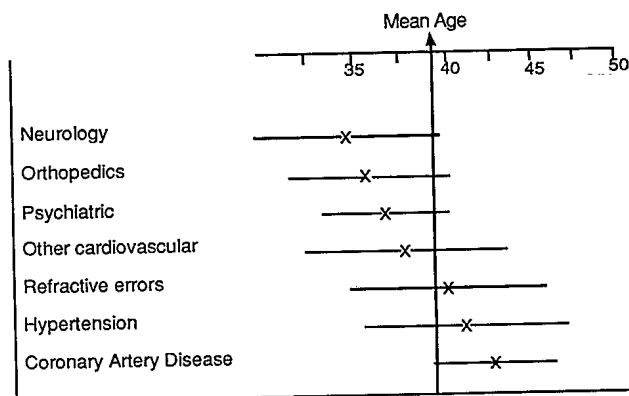


Fig. 1. Average age at the time of change of category (with standard deviation).

study, 20.7% were 40 years of age or older. Among this older group, coronary artery disease, refractive errors and hypertension were more common, while younger pilots were most frequently medically restricted or grounded because of orthopaedic (most commonly disc disease) or neurological problems (most commonly migraine).

The CF medical category system allows the definition of any operational flying restriction appropriate for the medical condition. The number of the most common restrictions imposed is given in Table III.

DISCUSSION

Medical screening of aircrew candidates is designed to select candidates for flying training who hopefully can complete their career without requiring a medical restriction or grounding. By reviewing the medical causes of loss of full operational effectiveness in aircrew, medical selection procedures may be advantageously revised. Primary prevention programs may also be suggested for experienced aircrew.

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TABLE III. OPERATIONAL FLYING RESTRICTIONS IMPOSED FOR MEDICAL REASONS.

Restriction	Number
With or as copilot	85
*Unfit Class A aircraft	36
With or as copilot, unfit Class A	24
†Unfit Class A and Class D aircraft	20
‡Restricted from CF5/CF18/CH136 NOE	19
Others	25
Total	209

* Class A are ejection seat aircraft; †Class D are helicopters; ‡CH136 refers to tactical helicopter nap-of-the-Earth operations.

Over the period of this review, coronary artery disease ranked as the number one cause of permanent loss of experienced aircrew, accounting for 25% of the permanent groundings. Cardiovascular disease, including hypertension, accounted for 27% of medical restrictions and/or groundings. Among the cardiovascular diseases other than coronary artery disease, mitral valve prolapse was the single most prevalent condition. These findings are similar to a recent review of medical disqualifications in the USAF by Whitton (5).

One striking difference between Whitton's data and this review is that diabetes mellitus ranked fourth as a cause of permanent disqualification in USAF aviators, while it was a rarely reported disorder in this study with only a single case. The explanation for this difference is not obvious; CF pilots are screened for blood and urine sugar levels on their annual medical examination, so it is unlikely that the diagnosis is being missed.

The problem of cardiovascular disease in CF aircrew is currently being addressed in several ways. Since 1986, aircrew candidates have been screened by echocardiography. Mitral valve prolapse or other structural cardiac conditions are disqualifying for pilot selection. Candidates are also screened for dyslipidemia, and a finding of significant hyperlipoproteinemia is also disqualifying. A programme for screening experienced CF aircrew for hyperlipidemia is being organized, and a trial is presently being carried out.

Hypertensive aircrew are operationally restricted primarily because of the side effects of the treatment required, rather than the hypertension *per se*. Only thiazides are allowed with no flying restriction. Angiotension-converting enzyme inhibitors may provide a second class of antihypertensives which can be used without the need for a flying restriction, but these require further evaluation before being approved for use with no restriction.

Refractive disorder leading to a decrease in visual acuity is the single condition most frequently responsible for an operational flying restriction. Currently, a pilot whose visual acuity falls to category V3 (i.e., less than 6/18 in both eyes, or 6/12 better eye, 6/30 other eye) is restricted from fighter operations, and tactical helicopter nap-of-the-Earth operations. The current initial selection standards allow a cycloplegic refractive error no greater than -0.25 D spherical equivalent. If all candidates were required to be plano or better, it is likely

that the number of restrictions required later would be significantly reduced. However, such a change would eliminate a significant percentage of otherwise acceptable candidates. The continuing progress in the technology of contact lenses, and their obvious advantage over spectacles in terms of peripheral vision, lack of distortion, and lack of fogging, may allow their unrestricted use by pilots in future, and make the rationale for a flying restriction based solely on visual acuity more difficult to justify.

Low back pain was the second most common cause for an operational flying restriction in this study. This diagnosis raises the question as to whether routine back X-rays should be included in aircrew candidate screening. However, the radiation exposure from such studies is significant (~650 mrem), and the significance of many findings is controversial (4), making them difficult to justify as a routine screening procedure. At the recent AGARD symposium on backache (1), modifications in seat configurations and improved design in future cockpits were recommended, and the importance of a structured programme of back care education was emphasized.

Overall, the rate of permanent medical grounds of CF pilots in this review period (i.e., at 2.2/1,000) was only about half that reported in the USAF (i.e., 4.1/1,000) (5). However, at that time, the USAF had a fly-one, fly-all policy, with no categorical flying restrictions. Since many of the CF pilots in this study group who were awarded operational flying restrictions would have been permanently grounded if in the USAF, the two studies are not readily comparable.

Interestingly, over the 10-year period of this study, there were no cases of an idiopathic seizure disorder. One pilot had an isolated seizure, and one other pilot had two separate seizures related to alcohol withdrawal. In Whitton's review (5), 2.3% of the USAF disqualifications were for a seizure disorder or abnormal EEG. Although the value of the EEG as a screening tool for seizure disorders is controversial (2,3) this review suggests that the CF policy of screening aircrew candidates for EEGs is cost-effective and worthwhile. The Canadian Forces continue to screen all pilot candidates with an electroencephalogram; over the past 5 years two candidates have had a seizure during the screening EEG at the Central Medical Board. These individuals would otherwise have been medically cleared for pilot training.

CONCLUSIONS AND RECOMMENDATIONS

The present system for the medical screening of Canadian Forces aircrew candidates has worked very well, and should be continued, including screening EEGs. Refinements introduced over the past 5 years should help further reduce the incidence of the more common problems in experienced aircrew documented in this study. These changes include echocardiographic screening, screening for hyperlipidemia, pulmonary function testing and individual review by a Flight Surgeon and, if indicated, an Internist, at the time of aircrew selection. These measures should reduce the incidence of structural cardiac abnormalities including

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mitral valve prolapse and coronary heart disease in future aircrew.

Plans to screen current CF aircrew for coronary risk factors and to provide primary preventive intervention should be expedited to reduce the incidence of coronary heart disease in experienced aircrew.

Because of the frequency of back problems, considerations should be given to including back care education as part of routine aeromedical training for aircrew.

It will be interesting to conduct another review a decade from now to assess the impact of these procedures on the medical groundings and flying restrictions in our CF pilot population.

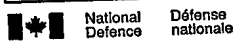
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