Original Article

An analysis of morbidity pattern among civil aircrew

Wg Cdr P Pant*, Brig H Malik+, Wg Cdr D Gaur#

ABSTRACT

Medical disability in an aircrew may lead to temporary unfitness for flying duties or permanent denial of flying license. An analysis of medical evaluation data provides insights into the morbidity pattern among a particular professional group. This study was carried out to analyse the morbidity pattern among commercial aircrew in India from 1997-2002. A total of 516 cases were made temporarily/permanently unfit during initial and renewal medical examinations. 108 (20.93%) cases were declared permanently unfit at the time of initial medical examination. 348 (67.44%) cases were declared temporarily unfit while 60 (11.63%) cases were declared permanently unfit during their renewal medical examinations. Among the permanent rejections at the time of initial medicals, EEG abnormality (23.14%) was the leading cause for rejection, while Coronary Artery Disease and Hypertension, combined together were the main causes of temporary (26.72%) and permanent (38.34%) rejections at the time of renewal medical examinations. IGT/DM accounted for 34 (9.78%) cases of temporary denial of license. Approximately one-sixth of the aircrew were detected to be overweight by more than 20% over their ideal weight. The study provides a better understanding of factors related to aircrew medical fitness vis-à-vis flight safety, with particular reference to early detection and prevention of health problems. It is essential that the thrust of medical examinations in healthy individuals should continue to remain on early detection and prevention of illness.

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Flying is a highly skilled job that involves a complex interaction between the aviator and the machine in an environment that is full of stressors. Thus, the physical and mental fitness of flight crew must be maintained at a very high level of efficiency in flying modern aircrafts. Aircrew do not live as an isolated group but are an integral part of the society. Therefore they are subjected to all the health risks as the rest of the population. A medical disability in an aircrew may lead to discontinuity in flying for a temporary period. If the disease process is not arrested in time, then it may also lead to permanent denial of flying license. However, since they are a highly skilled group trained at a very high cost, the objective of their health management is to utilize their skills and training not only optimally but also effectively and to the maximum possible extent.

Civil aircrew are medically assessed for initial issue or renewal of their flying license as specified by ICAO in Annex 1[1]. Two basic principles govern the assessment of an applicant's medical fitness for licensing for aviation duties, namely:-

* *Classified Specialist (Aviation Medicine)*
Air Force Station, Halwara

+ *Commandant, 158 BH, C/O 99 APO*

Associate Professor (Aviation Medicine)
Institute of Aerospace Medicine, IAF, Bangalore- 560017

(a) The applicant should be physically and mentally capable of performing the duties of the license held or applied for

(b) There should be no medical reasons, which make the applicant liable to incapacitation in air, that could jeopardise flight safety

The general medical requirements for civil aircrew are classified as under (vide Chapter 6 of Annex 1, ICAO Manual of Civil Aviation Medicine) [1, 2] :-

(a) Physical and mental
(b) Visual and colour perception
(c) Hearing

To determine the common ailments that lead to temporary or permanent unfitness, a comprehensive analysis of available data needs to be undertaken. This study was carried out to analyse the morbidity among civil aviators in India.

Material and Methods

The data for this study consisted of both initial and renewal medical examination records of commercial aircrew who underwent medical examination at the designated medical examination centres in India. The detailed records of both initial and renewal medical examinations of aircrew are maintained at DGCA in Medical Examination Registers. The registers were the prime source of data for this study. The records from Jan 1997 to Dec 2002 were accessed and information was collated for analysis.

Results

During the study period, a total of 516 commercial flight crewmembers were detected to be medically unfit for flying during the initial/ renewal medical examination. Out of these, 108 cases were declared permanently unfit at the time of initial medical itself, which constitutes 20.93% of the total unfit cases. Among the experienced aircrew, 67.44% (n=348) were declared temporarily unfit and 60 cases were declared permanently unfit.

Medical examination registers revealed that on an average 5260 initial/renewal medicals are conducted annually. During this six year period, approximately 5,100 Class I licenses were issued (averaging 850 licenses per year) on completion of initial medical examination.

As shown in Table 1, out of a total of 108 permanently unfit cases at initial medicals, 50 (46.29%) cases, were made permanently unfit on account of physical and mental disability, whereas 43.51% and 10.18% cases were declared permanently unfit on account of visual/colour perception and hearing disability respectively. EEG abnormality was the leading disability (n=25, 23.14%) in the physical and mental group, whereas substandard vision (n=13, 12.03%) and conductive hearing loss (n=5, 4.62%) were the leading causes among ophthalmic and ENT disabilities.

As shown in Table 2, a total of 348 cases were made temporarily unfit during renewal medical examinations. Physical and mental illnesses accounted for more than three-fourths (n=287, 82.47%) of the total aircrew who were made temporarily unfit during renewal medical examination. Of these, Hypertension was the leading cause (n=71, 20.40%). There were 29 cases of Coronary Artery Disease (CAD) (8.34%). Ophthalmologic and ENT disabilities accounted for 8.62% (n=30) and 8.90% (n=31) of rejection respectively (Table 2).

Table-1 : Initial Medicals: Permanently unfit cases

Disability	Total no. of cases
Physical and Mental	
EEG abnormality	25(23.14%)
Aortic Regurgitation/MVP	5(4.63%)3
Diabetes Mellitus	4(3.70%)
ECG abnormality	2(1.85%)
Pulmonary Koch's	2(1.85%)
Anxiety state	2(1.85%)
Misc	10(9.26%)
Visual and Colour Perception (Eye)	
Sub standard vision	13(12.03%)
Defective colour perception	12(11.11%)
LASIK / PRK surgery	6(5.55%)
Squint	4(3.70%)
Cataract	1(0.92%)
Misc	11(10.18%)
Hearing (ENT)	
Conductive hearing loss	5(4.62%)
Otitis media with perforation	4(3.70%)
Misc	2(1.85%)
Total	**108**

As shown in Table 3, out of a total of 60 cases, that were declared permanently unfit during renewal medicals, 85% were on account of physical and mental disability. Visual/colour perception and hearing disability accounted for 7 (11.67%) and 2 (3.33%) cases respectively. CAD contributed to 23 (38.34%) of permanent rejections.

As shown in Table 4, ALTP and CPL holders totaling 146 and 130 respectively contributed the major share of temporary unfitness. 45 CHPL holders were also made temporarily unfit on account of various disabilities; hypertension being the major cause. This trend can be attributed to the larger numbers of ALTP and CPL holders in India. Hypertension was also labelled as the major cause of temporary unfitness among CPL and ALTP holders (n=50, 14.36%). Next cause of temporary unfitness was IGT/ Diabetes Mellitus (DM) (9.77%) among all types of license holders followed by CAD (8.34%).

As shown in Table 5, among the permanently unfit cases, almost three-fourths (n=45, 75%) of the rejections were from CPL and ALTP holders. Of these 60 cases, 35 (58.3%) were ALTP holders. Major cause of grounding was attributed to CAD among ALTP holders. This alone amounted to 28.3% of the total number of permanently unfit cases.

Table 6 shows the distribution of disabilities in terms of temporary and permanent unfitness during issue of license as discussed in the preceding paragraphs. Out of 348 temporary denials, 8 aircrew had more than one disability, which accounts for 2.29% of cases. Similarly, out of a

Table-2 : Renewal Medicals: Temporary unfit cases

Disability	Total
Physical and mental	
Hypertension	71
IGT/Diabetes Mellitus	34
CAD	29
ECG Abnormality	23
Inguinal Hernia	20
Eosinophilia	13
Abnormal LFT/Bio./Lipid Profile	11
Aortic Regurgitation/MS/MVP	7
Lung Infection	7
Visual and colour perception (Eye)	
Refractive Error/Lenticular Opacity/Defective Colour Vision	9
Convergence Insufficiency/Squint	6
Trachoma/Scleritis	4
Diabetic Retinopathy	4
Hearing (ENT)	
DNS/Fracture Nasal Bone	11
Otitis Media	9
Perforated TM	4
Others (All groups inclusive)	86
Total	348

Table-3 : Renewal Medicals: Permanently unfit cases

Disability	Total
Physical and Mental	
CAD	23
IGT / Diabetes Mellitus	4
Hypertension	2
Affective Disorder	2
Visual and Colour Perception (Eye)	
Colour Perception	2
Sub Std Vision	2
PRK/Lasik Surgery	2
Hearing (ENT)	
Hearing Loss	2
Others (all groups inclusive)	21
Total	**60**

total of 168 (108 among initial and 60 among renewals) cases, 11 (6.54%) aircrew (4 during initial issue and 7 during renewal of license) had permanent denial of license due to more than one disability.

Discussion

Examining a healthy person may seem an easy task, and sometimes a rather futile thing to do, for what can one expect to find when nothing is wrong? In reality, the periodic examinations of aircrew are both difficult and demanding, but may be quite rewarding when performed with interest, care and thoroughness. Applicants for flying license are required to undergo initial/renewal medical examination of the license applied for or held. The frequency of medical examination varies as per the type of license and age of the applicant as laid down in the ICAO guidelines.

A license applicant/holder is legally obliged to undergo initial/regular health examinations, performed by either an Authorised Medical Examiner (AME) or an Aeromedical Centre or a similar Aviation Medicine institution. In India, Class I medical examinations, both initial and renewal are conducted at designated Air Force centres only. When interpreting the Standards and Recommended Practices (SARPs), it is important to bear in mind the purpose of having a set of established standards and of performing aeromedical examinations to ensure that these standards are met. The two basic medical and administrative principles for assessment of aircrew fitness include:-

(a) Ability to perform assigned or designated duties and

(b) Flight safety considerations

Table-4 : Unfitness vis a vis type of license held at renewal medicals: Temporarily unfit cases

Disability	Type of License Held							Total
	CPL	ALTP	SCPL	ALTPH	CHPL	FE	FNL	
Physical and Mental								
Hypertension	15	35	3	1	11	5	1	71(20.40%)
IGT/Diabetes Mellitus	11	15	1	-	7	-	-	34(9.77%)
CAD	3	19	-	-	5	2	-	29(8.34%)
ECG Abnormality	10	8	-	-	5	-	-	23(6.60%)
Inguinal Hernia	4	13	-	-	2	1	-	20(5.74%)
Eosinophilia	10	3	-	-	-	-	-	13(3.73%)
Abnormal LFT/Bio./Lipid Profile	4	4	-	-	2	1	-	11(3.16%)
Lung Infection	5	-	-	-	1	1	-	7(2.01%)
Aortic Regurgitation/MS/MVP	5	1	-	1	-	-	-	7(2.01%)
Visual and Colour Perception (Eye)								
Refractive Error/Lenticular Opacity/Defective Colour Vision	2	4	-	-	1	1	1	9(2.58%)
Convergence Insufficiency/Squint	4	2	-	-	-	-	-	6(1.72%)
Trachoma/Scleritis	4	-	-	-	-	-	-	4(1.15%)
Diabetic Retinopathy	-	4	-	-	-	-	-	4(1.15%)
Hearing (ENT)								
DNS/Fracture Nasal Bone	10	-	-	-	1	-	-	11(3.16%)
Otitis Media	5	2	-	-	2	-	-	9(2.58%)
Perforated TM	-	3	-	-	-	1	-	4(1.15%)
Others (All Groups Inclusive)	38	33	3	-	8	4	-	86(24.92%)
Total	130	146	7	2	45	16	2	348(100%)

Table-5 : Unfitness vis a vis type of license held at renewal medicals: Permanently unfit cases

Disability	Type of License Held							Total
	CPL	ALTP	SCPL	ALTPH	FE	CHPL	FNL	
Physical and Mental								
CAD	1	17	-	-	1	3	1	23(38.34%)
IGT/Diabetes Mellitus	1	3	-	-	-	-	-	4(6.67%)
Hypertension	-	1	-	-	1	-	-	2(3.34%)
Affective Disorder	-	-	1	-	-	1	-	2(3.34%)
Visual and Colour Perception								
Colour Perception	1	1	-	-	-	-	-	2(3.34%)
Sub Standard Vision	2	-	-	-	-	-	-	2(3.34%)
PRK/LASIK	2	-	-	-	-	-	-	2(3.34%)
Hearing (ENT)								
Hearing Loss	1	1	-	-	-	-	-	2(3.32%)
Others (All Groups Inclusive)	2	12	1	-	1	5	-	21(35%)
Total	10	35	2	-	3	9	1	60(100%)

Table-6 : Distribution of disabilities in terms of temporary and permanent unfitness during issue of license

Category of Disability	Temporary Unfitness Total Renewals (N=348)	Permanent Unfitness		
		Initial (N=108)	Renewal (N=60)	Total (N=168)
Physical and Mental	287(82.47%)	50(46.30%)	51(85%)	101(60.11%)
Visual/Colour Perception	30(8.62%)	47(43.51%)	07(11.67%)	54(32.14%)
Hearing (ENT)	31(8.90%)	11(10.18%)	02(3.34%)	13(7.75%)

The disabilities in the present study were classified into three categories viz. physical and mental, visual and colour perception, and hearing (ENT) as per ICAO medical requirements. Sant [3] carried out a retrospective study of 1948 disabilities detected at the evaluating centers in India from 1966-1975. Among these the major disabilities were surgical (43.3%) and medical (39.8%).

When EEG is conducted at the time of initial medicals, those with persistent specific EEG abnormalities are declared unfit, as they are prone to seizures/lapse of consciousness especially under stressful flying situations. However, EEG is not a mandatory ICAO requirement. In the present study, 25 (23.14%) out of 108 permanently unfit cases during initial medical examination had EEG abnormality. This accounts for only 0.48% of total number of candidates who reported for initial medical examination.

The Netherlands Aeromedical Institute has calculated a 25% probability that a candidate with epileptiform EEG, but without a history of epileptic seizures, will develop seizures during his flying career. Epileptiform EEG discharges, at times may be associated with episodic functional impairment [4]. In the IAF, requirement of EEG for transport and helicopter aircrew has been withdrawn, however, it is a mandatory requirement for the fighter aircrew [5]. In view of the substantial number of false positive cases and lack of uniformity in EEG interpretation, the value of EEG as a screening procedure remains controversial.

Another disability that was detected at the time of initial and renewal medicals was Diabetes Mellitus (DM) resulting in temporary/ permanent denial of license. DM is a metabolic disease that causes considerable morbidity. Hyperglycemia and atherosclerosis are associated with it, thus a diabetic individual is more prone to myocardial ischaemia/infarction, cerebral thrombosis and hypertension. Of greater concern in aviation are the chances of hypoglycemia in an aircrew who may resort to drug therapy without informing the aeromedical examiner. All these can cause sudden incapacitation in flight. An earlier study had also documented DM/GTT abnormality in 29.21% of civil aircrew in India [6].

In the present study, disabilities of the eye were one of the major causes of permanent denials at the time of initial medical examination. Majority of the rejections were on account of substandard vision and defective colour perception. These findings are similar to those reported earlier [7].

A total of 348 commercial flight crew were denied renewal of their license temporarily on one

or more occasions and for one or more disabilities. The duration of temporary unfitness varied from weeks to years. The causes of temporary unfitness are as depicted in Table 2 in terms of their renewal medical examination. Cardiovascular group comprising of CAD/Hypertension was a major contributor to this type of unfitness. Hegde [8] analysed 1262 records of Disability Medical Boards from 1975-1977. The four leading causes of the disability boards were diseases of the cardiovascular system (25.83%), injury to extremities (14.10%), endocrine/metabolic disorders (12.04%) and eye disorders (8.63%).

Another study, but over a different time period also highlighted that the system most commonly involved was cardiovascular (26.66%) followed by the gastrointestinal (8.14%) and endocrine systems (6.32%) [9]. Results of both the above studies in terms of cardiovascular involvement are more or less similar to the present study. All the above studies reflect that cardiovascular disabilities have consistently remained the leading cause of unfitness during renewal medical examination of civil aircrew.

Among the cardiovascular causes, ECG abnormality also led to temporary denial of license while undergoing renewal medicals. In the present study, ECG abnormality was predominantly in the form of RBBB and multiple VPCs. Hegde [8], in his study also highlighted that ECG abnormality was the leading cause of disability. Nayar [10] had also reported that cardiovascular causes accounted for 48.5% of medical unfitness among civil aircrew in India at the time of renewal medicals. Mukerjee and Seth [8] in their study of medical records of civil aircrew also revealed that 21.0% of the total denials at the time of renewal medicals (temporary/permanent) were due to IHD/ECG abnormality.

Among the borderline high blood pressure cases, use of 24 hour ambulatory blood pressure record helped to detect several cases of White Coat Hypertension and avoided unnecessary unfitness. Even on confirmation of a diagnosis of Hypertension in an aircrew, the crew is grounded temporarily for eight weeks for evaluation for any target organ involvement and associated risk factors. In most cases salt restriction, exercise and reduction in body weight were all that was required to maintain blood pressure at a normal level and medical fitness for issue of license. Few cases however, required permissible doses of anti-hypertensives for stabiliszation of blood pressure to normal range.

In the present study, DM/IGT accounted for 34 (9.77%) cases among the metabolic disorders. Nayar [10] had reported that apart from cardiovascular causes, metabolic abnormalities account for 22.4% of medical unfitness during renewal medicals among civil aircrew. He also brought out in his study that IGT (28.9%) and ECG abnormalities (25.9%) led to maximum temporary denial of licenses. In the present study, during renewal medicals, DM /IGT was the second leading cause of temporary denial of license after Hypertension. One of the problems with DM is that quite a few aircrew seem to achieve accepted level of control during temporary grounding, but the control breaks down on resuming flying because of stress and irregular meals.

Biochemical parameters are investigated routinely during initial and subsequent medical examination coinciding with the periodicity of stress test. In the present study, haematological disorders constituted one of the common causes of temporary unfitness in aircrew. These included eosinophilia, anaemia/raised ESR and splenomegaly. Eosinophilia was an important cause

for temporary grounding in aircrew, majority of these were during renewal medical examination (3.73%). Ghosh and Gupta [7] in their study had also brought out that eosinophilia is an important cause of temporary rejections at the time of renewal medicals. This increase of eosinophilic count could probably be attributed to allergic manifestation.

In the present study, the prominent cardiovascular disability responsible for permanent denial of licenses among experienced commercial aircrew was CAD. Turner and Caris [11] carried out a study of disease pattern amongst aircrew where diseases of the circulatory system accounted for 35.27% cases. In another study, Bennet and O'Connor [12] had also reported cardiovascular diseases, flying accidents and psychiatric illness as the chief causes (about 75%) of medical wastage of trained professional aviators in their comparative study for the years 1963-68.

Analysis of total number of permanently unfit cases during medical evaluation revealed that on an average about 28 aircrew are declared permanently unfit every year during initial and renewal medical examination. This is roughly about 0.54% of total commercial license holders. These observations are similar to the observations made in one of the earlier studies [7].

Obesity has been given utmost importance during selection and subsequent aeromedical examination of aircrew in the recent years. During the course of this study, more than 15% of aircrew were found to be obese by 20% or more above the ideal weight. Ghosh [7] in his study had brought out that 10% of commercial aircrew were obese with more than 20% above ideal body weight. Obesity per se, without any other associated disability is not a cause for rejection for commercial flying. But, it is well established that obese individuals are more prone to disabilities like CAD, DM, Hypertension and Osteoarthritis.

On comparison of findings of the present study with those reported earlier, it is seen that there has been an increase in the number of denials in aircrew, either temporarily or permanently for all flying duties [7,10]. This is due to the fact that the average number of initial and renewal medicals conducted annually has increased from 3757 to 5260 [7]. This increase can be attributed to the larger number of aspirants in the last 10 years because of increasing job opportunities as newer airlines are coming up with expansion of aviation industry in India.

During the period from 1987–1994, it was observed that ECG abnormality, substandard vision, defective colour perception were the common causes of denials during initial/renewal medical examination [12]. The three major causes of denials on initial medical examination in the present study were EEG abnormality, substandard vision and defective colour perception, whereas among the experienced aircrew, during renewal medicals temporary denials were as a result of IGT/DM, ECG abnormality and CAD. Permanent denials during renewal medicals were mainly due to CAD and IGT/DM. Disability trend over past few decades has shown that cardiovascular and endocrine/metabolic disease continue to be an important causes for rejections [8, 9, 10, 12]. The change in the morbidity pattern during initial and renewal medical examination could be because of individual life styles and age related problems.

Conclusion

The main purpose of aeromedical examination is to identify potential hazards for flight safety. In the present study, majority of cases were declared unfit due to cardiovascular or metabolic disorders. CAD, Hypertension and DM were the commonest among experienced aircrew who reported for their renewal medical examination suggesting a need for early detection of these diseases.

Obesity is considered as the gateway to many diseases. The increasing prevalence of obesity is a cause for concern. Aeromedical examiners should emphasise the preventive aspects of obesity to aircrew. Lifestyle modifications should be advocated. While knowledge is fundamentally important, it is education of others, sharing of ideas and experiences, and effective communication that will allow us to reach our ultimate goal of minimising morbidity among the civil aircrew.

References

1. Manual of Civil Aviation Medicine. 2nd ed. Canada: ICAO, 1985.

2. Trump DW. Medical standards for civilian aircrew. In: Ernsting J, King P. Aviation Medicine. 2nd ed. London: Butterworths 1988: 503.

3. Sant JS. The present disability pattern in aircrew. Aviation Medicine 1976; 20(2): 24-27.

4. Hendriksen IJ, Elderson A. The use of EEG in aircrew selection. Aviat Space Environ Med 2001; 72: 1025-33.

5. Manual of medical examinations and medical board (IAP 4303). 3rd ed. New Delhi: Air Headquarters, 2003.

6. Mukerjee SK, Seth VK. Disability pattern amongst civil aircrew. Aviation Medicine 1978; 22(1): 46-49.

7. Ghosh PC, Gupta JK. Morbidity pattern in civil aircrew and the medical assessment system for civil aviator in India. Ind J Aerospace Med 1999; 43(2): 24-28.

8. Hegde KP. Disability pattern in aircrew. Aviation Medicine 1978; 22(1): 20-23.

9. Singh RJ. Analysis of morbidity pattern among aircrew reporting for medical evaluation. Field project report 1995; Institute of Aerospace Medicine (IAF).

10. Nayar GS. Analysis of disability pattern among commercial civil aircrew in India. Ind J Aerospace Med 1983; 27(1): 25-29.

11. Turner GL, Caris TN. Borderline medical problems and fitness for flying. Aerospace Med 1968; 39: 184-88.

12. Bennet G, O'Connor PJ. Medical wastage of military and civil aircrew in Great Britain 1963–68. Aerospace Med 1970; 41: 550-52.