The Maintenance of Wakefulness Test as a Predictor of Alertness in Aircrew Members with Idiopathic Hypersomnia

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aviation, hypersomnia, MSLT, MWT, pilots.

Aviators are required to maintain a high level of alertness during their missions. Two conditions that may disrupt this alertness are fatigue and hypersomnia. Fatigue is a physiological state, while hypersomnia is a pathologic state, also termed excessive daytime sleepiness (EDS), which is manifested by the tendency to fall asleep in inappropriate places or situations, such as during flight or driving. Hypersomnia may be diagnosed by subjective measurements, such as the Epworth sleepiness scale, but the diagnosis is established by two objective tests: the Multiple Sleep Latency Test (MSLT) and the Maintenance of Wakefulness Test (MWT). The first consists of four 20-min sessions used to determine the time it takes the patient to fall asleep when given the opportunity and is considered positive when the sleep latency time is shorter than 5 min, although some authors use 8 min as the cut-off for the diagnosis. The Maintenance of Wakefulness Test (MWT) consists of four 40-min sessions during which the patient attempts to maintain wakefulness while seated in a dark, quiet room during the day. Herein we report 2 cases of aviators who were returned to flying duty despite a pathologic MSLT. These aviators were waivered based on a normal MWT and safety history obtained from their commanders.

Keywords: aviation, hypersomnia, MSLT, MWT, pilots.

Case 1: A 24-yr-old helicopter pilot self-reported with complaints of excessive daytime sleepiness in January 2002. There were no reports of falling asleep involuntarily. He reported sleeping sufficiently during the night, an average of 6-7 h, and occasionally had a daytime nap. He attributed his sleepiness to an excess of free time and claimed to be fully awake while on a busy schedule. His mother and sister suffered from B12 deficiency, but there were no sleep-related disorders in his family. He underwent a polysomnography in which the sleep latency time was found to be 7 min with a REM latency of 95 min. Two complete sleep apneas and two partial sleep apneas were observed and eight episodes of desaturation were noticed. Snoring was observed on 8.1% of the sleep time. The apnea/hypopnea index was 0.9. This test was followed by a MSLT in which he fell asleep on all five attempts with a mean latency time of 3 min. REM was reached on 8.1% of the sleep time. The apnea/hypopnea index was 0.9. This test was followed by a MSLT in which he fell asleep on all five attempts with a mean latency time of 3 min. REM was reached on two attempts. A diagnosis of idiopathic hypersomnia was established. He underwent an additional polysomnography in which normal sleep pattern was observed. No disturbances were witnessed in heart rate, breathing pattern, or EEG. An MWT was subsequently performed on which he maintained wakefulness on all five attempts. He was returned to flying duty with a copilot.
and reported no alertness problems since his return to flying duty.

Case 2: A 21-yr-old attack helicopter pilot was referred to the Israel Defense Forces/Air Force Aeromedical Center in November 1996 after a single episode of falling asleep during flight that was reported by a fellow crewmember. There were no other such reports in his past. The pilot did not remember the event and denied any sleep disturbances or cataplexy. He claimed to sleep well an average of 6 h a night without snoring. There was no family history of sleep disorders. He underwent a polysomnography in which the sleep latency time was found to be 9 min and REM latency time was found to be 149 min. There were no episodes of apnea or hypopnea and heart rate and EEG were normal. An MSLT was subsequently performed in which he fell asleep on all five attempts with a mean latency time of 8 min. REM sleep was reached on two of the attempts. He subsequently underwent an additional polysomnogram followed by an MWT, on which he was given five attempts to maintain wakefulness and succeeded in all of them. Following these tests, a diagnosis of idiopathic hypersomnia was established and he was returned to flying duty with a copilot. After 2 mo of flight with a copilot, he was returned to active duty as a single pilot. He has been followed for 6 yr since with no problems related to alertness reported by the pilot or his commanders.

AEROMEDICAL CONCERNS

Alertness is an obvious requirement for flight performance and safety. Fatigue is a major concern in modern aviation where combat issues push to maximize flight hours, thus reaching the flight safety borders. In recent years, attempts have been made to use stimulants to increase alertness and many studies are underway regarding this issue. Sleep disorders are more common than generally supposed and estimates are that their prevalence in the general population is 13–49% (3). Despite this high incidence, sleep disorders are not commonly reported in U.S. military aviation. It is estimated that there are 125,000 cases of idiopathic hypersomnia in the U.S. alone, but the USAF and the U.S. Army reported only 2 cases each between 1985 and 1996. Both cases in the U.S. Army were disqualified, whereas both cases in the USAF were returned to flying duty (14). These reports certainly do not represent the actual number of patients with idiopathic hypersomnia, and this probably stems from the combination of aircrew reluctance to report and from difficulty in data gathering. The different outcomes of these aircrew personnel reflect the fact that there are no objective measures to appreciate aviation fitness and thus raise the necessity of a functional test that will enable the flight surgeon to make adequate decisions. The same holds true for commercial and non-commercial drivers with sleep disorders, where considerable variations regarding driving regulations exist between different states and different countries. Poceta et al. recommended that patients should not be allowed to drive if their MWT mean is less than 15 min, which was approximately 1 SD below the mean for sleep apnea patients in their series (9), but no standard has been set regarding the MWT in aviators or drivers. Since aviators and commercial drivers have much in common regarding the need to maintain alertness, setting objective criteria common to both professions may be appropriate.

The diagnosis of idiopathic hypersomnia is based on the patient’s history and is made only after other causes, such as narcolepsy and obstructive sleep apnea, have been ruled out by polysomnography. The MSLT is used to establish the diagnosis and to rule out alternative diagnoses, such as narcolepsy. It may be abnormal in such situations as sleep deprivation, circadian rhythm abnormalities, substance abuse, and nocturnal sleep disorders (14). Although considered a crucial part of the diagnosis of idiopathic hypersomnia, the MSLT has its drawbacks. First, it assesses only sleepiness and does not address the elements of arousal (12). This limits the test’s reliability because the individual may try to remain awake in order to prove his functional capabilities. In cases of aviators, whose career is at stake, this issue may be particularly significant. The MSLT also fails to discriminate between sleepiness, which may be a normal situation without any social implications, and idiopathic hypersomnia, which may cause a social disability (13). Again, in cases where vigilance is crucial to optimal functioning, such as in aviators or commercial drivers, this discrimination is crucial and should be made. The MWT is considered complementary to the MSLT in the diagnosis of sleep disorders. This test does not contribute significantly to the diagnosis, but helps determine its functional implications. It is considered particularly useful in assessing response to treatment (11). In contrast to the MSLT, it assesses the combined effects of the sleep and the arousal systems (12), thereby assessing the patient’s ability to maintain wakefulness despite his tendency to fall asleep. Thus, it may be particularly useful in clinical situations where the main issue is the ability of the patient to remain alert, such as in commercial drivers or aviation personnel.

In our pilots, a diagnosis of a sleep disorder was suspected on clinical grounds. A diagnosis of obstructive sleep apnea was ruled out by the normal polysomnography. A diagnosis of narcolepsy was not established in either of the pilots despite the occurrence of two episodes of REM sleep on the MSLT because neither of them had a history of falling asleep involuntarily, except for a single episode in one of the pilots, and neither had cataplexy. In addition, the occurrence of two episodes of REM sleep on the MSLT is less specific for narcolepsy than the occurrence of three or more episodes (1). The positive predictive value for narcolepsy of a sleep onset REM period at the onset of a nighttime polysomnogram (68%) exceeds that of the occurrence of two sleep onset REM periods on an MSLT (57%) (4). Neither pilot had sleep onset REM period at the onset of the nighttime polysomnogram.

Aviators and commercial drivers with sleep disorders are generally considered unfit to maintain their jobs (6). Disqualification of aviators, whose training is expensive and time-consuming, has significant implications. It is imperative, therefore, that aviators undergo a
thorough assessment before disqualifying them for flight duties. In this regard, we believe that all aviators with suspected sleep disorder should undergo an MSLT. If this test discloses findings consistent with idiopathic hypersomnia, an MWT should be performed in order to assess the functional implications of the diagnosis. In cases of obstructive sleep apnea or narcolepsy with impaired alertness, we believe that disqualification should be made with no exception. We also believe that cases requiring medical therapy should be disqualified, since their wakefulness level is sufficiently impaired to require treatment. When the diagnosis of idiopathic hypersomnia is made but the MWT is found to be normal and no drug treatment is required, a waiver may be granted to fly under certain limitations, such as flying with a copilot.

CONCLUSIONS

Alertness in aircrew members is a crucial element for optimal functioning. Hypersomnia may jeopardize this alertness and lead to functional impairment. Yet, subjective complaints of sleepiness may not reflect the patient’s ability to stay awake and alert at times when this is necessary. In aviators, it is mandatory not only to make the diagnosis, but also to appreciate functional capacities regarding sleepiness. In this regard, the MWT may be a superior tool compared with the MSLT, because it was designed to assess degree of alertness. The decision regarding an aircrew member’s qualification should, therefore, rely on the MWT as well.

We believe that aircrew with sleep disorders should generally be disqualified, but that in certain cases of idiopathic hypersomnia, a waiver may be granted based on the MWT and the pilot’s flight and safety history. This will prevent automatic disqualification of aviators who suffer from sleepiness with no functional implications and may lead to more reliable reporting regarding sleep problems by aviators. Even under these circumstances, we believe that the aviator should be placed under certain limitations, such as flying with a copilot.

REFERENCES