



Federal Air Surgeon's Medical Bulletin

Aviation Safety Through Aerospace Medicine

For FAA Aviation Medical Examiners, Office of Aerospace Medicine Personnel,
Flight Standards Inspectors, and Other Aviation Professionals.

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from the Federal Air Surgeon's
PERSPECTIVE...

BY JAMES R. FRASER, MD, MPH

FAQS AND OSA SCREENING

In this issue of the *Federal Air Surgeon's Medical Bulletin*, I will do two things. First, address our most frequently asked questions and tell you why new guidance requires aviation medical examiners (AMEs) to screen *every* airman for risk of obstructive sleep apnea (OSA). Second, discuss the status of the new OSA process since its implementation on March 2, 2015.

Prevalence

OSA is increasingly prevalent in modern society. The medical literature initially estimated the prevalence of OSA as 2% for women and 4% for men. More recent data from The National Commission on Sleep Disorders Research estimates a prevalence of 4% for women and 9% for men. The prevalence increases with age. OSA remains undiagnosed in approximately 92% of affected women and 80% of affected men. Data from the Wisconsin Cohort Study indicate that the prevalence of OSA in people aged 30-60 years is 4-9% for women and 9-24% for men. Needless to say, OSA is increasingly recognized as a significant health and safety issue.

Fatigue

OSA is a major cause of fatigue. OSA inhibits restorative sleep and can cause excessive daytime sleepiness, personality disturbances, and cognitive impairments (decreased memory, attention, planning, problem-solving, and multi-tasking). Many individuals are unaware of these manifestations of OSA until they are treated. OSA is also associated with conditions such as refractory hypertension requiring more than two medications for control, diabetes mellitus, cardiac dysrhythmias, myocardial infarction, stroke, and sudden cardiac death.

Body Mass Index

Although the likelihood of having OSA needing treatment increases dramatically with increasing body mass index (BMI), up to 30% of OSA occurs in individuals with a BMI less than 30. Airmen with physical findings such as retrograde mandible, large tongue or tonsils, neuromuscular disorders, or connective tissue anomalies are at risk of OSA requiring treatment—despite a normal or low BMI.

Underdiagnosed

Due to the significant medical and safety implications of OSA, the fact that it is underdiagnosed in the U.S. pilot population,

the fact that it occurs in airmen with a normal or low BMI, as well as recommendations from the National Transportation Safety Board, we determined that *all* airmen should be screened for a risk of this disease.

Status

Next, I would like to discuss how pleased I am with the new OSA screening process since its March 2nd implementation. The screening process has worked very well to date. There have been very few problems with the software changes required to accommodate the new screening process into our electronic medical certification system. The video and OSA flowchart (see Dr. Carter's article, page 6) have been huge successes in terms of simplifying the screening process. We have had only a few cases where an airman was deferred and did not walk out with a medical certificate. In most of these cases, the airman was appropriately deferred for a potentially disqualifying co-morbid condition. The number of airmen receiving a medical certificate but were being asked to undergo further evaluation has been as we predicted.

The Aerospace Medical Certification Division and the Regional Flight Surgeons have been able to address almost all of the questions from AMEs, and most of the questions have been easily answered.

FAQs

We have kept track of the questions that were not so easily answered or were referred for additional policy clarification. To address these questions, we have developed a Frequently Asked Questions (FAQs) section to accompany the other resources available in the *Guide for Aviation Medical Examiners*. Thanks to your input, we have been able to address several questions that we had not previously considered. We encourage additional questions and will expand the FAQs as necessary.

Finally, I have many people to thank for the successful roll-out of the new OSA screening guidance. I will not attempt to list all of my FAA colleagues by name, lest I leave someone out. But most of all, I thank all of you, as AMEs, that have helped us respond to this significant health and safety issue. You are our front line, and your daily interactions with airmen greatly influence the safety of the National Airspace System.

Thank you for all that you do for the FAA, the flying public, and the airmen you examine.

—Jim

LETTERS TO THE EDITOR

Referred for an OSA Evaluation

Dear Editor:

Is there a link to this section of the article on alcohol by Dr. Jacobson ["Alcohol-Related Accident...," *Federal Air Surgeon's Medical Bulletin*, vol. 53, no.1, p. 8]? I had heard this years before at an FAA presentation, but now would like to study and read the original reference. Perhaps the cellular decomposition topic came from the Harper & Albers 1964 article, which was not listed in the bibliography.

...I hope the March 2, 2015, guidance on obstructive sleep apnea will specify the mechanics of bullet item 4 about "referred for an evaluation." Since any physician can evaluate, how will the diagnosis of OSA be obtained without a polysomnography of some type (lab or portable)? I am an AASM certified sleep physician myself and I suspect the BMI, neck, ESS, oropharynx, and snoring features of an evaluation are not enough, without some type of PSG, to validate a diagnosis worth approval by insurance for CPAP purchase and to expect standard compliance (70% of days, >4h/day) for treatment. So, there is surely at least a portable PSG in the line up to arrive at a special issuance for OSA, it seems to me.

Walter Warren
Bowling Green, Ky.

Dear Dr. Warren:

Thank you for your interest in Dr. Jacobson's article. This is the citation: *Aerospace Med.* 1964 May;35:462-4.

—Ed

Regarding your question about "at least a portable PSG in the line up to arrive at a special issuance for obstructive sleep apnea," the answer is: No. Please reference the [AASM guidelines](#). A sleep evaluation is needed when the triage process indicates that the airman is at significant risk for OSA to warrant further evaluation. The sleep evaluation may or may not require a sleep study in accordance with the guidelines. Notwithstanding your expertise in sleep medicine, the key issue is that the physician who performs the evaluation is deciding the necessity to conduct the sleep study and not a guidance document, policy, or regulation.

—FAA Office of Aerospace Medicine



DESIGNEE MANAGEMENT SYSTEM COMING THIS SUMMER

By BOBBY RIDGE

Responding to a U.S. Government Accountability Office audit, in 2014, the FAA Office of Aviation Safety (AVS) began implementing a fully integrated approach for managing its designees. The new approach brings together 14 AVS designee types into one policy supported by one information technology tool. FAA Order 8000.95, Designee Management Policy, was released in April 2014, and the initial release of the Designee Management System (DMS) tool was in June 2014 for two types of Aircraft Certification Service designees. The next release, due this summer, will specifically be for aviation medical examiners (AMEs).

Significant changes to the way we currently do business will include transitioning from a paper-based system to an electronic Web-based system. Designees, after creating a profile in DMS, will now have access to their information.

Once a year, they will be required to update their records, ensuring that the FAA has current information. Designee documents may now be uploaded conveniently from home or office with private messaging to the AME Program Analyst. The Certificate Letter of Authority and AME ID Card are downloadable from DMS. No longer will it be necessary to call the Regional Flight Surgeon's office or the Civil Aerospace Medical Institute for training date information. This information, along with the Individual AME Performance Report, will be readily available.

As we move closer to implementation, we'll provide guidance on what you can expect and what actions you'll need to take to be prepared for the transition to DMS. Stay tuned for more information on your Aerospace Medical Certification Subsystem homepage and the August 2015 Bulletin.

We appreciate your continued support and look forward to working with you through the deployment of DMS for aviation medical examiners.



Ms. Ridge is the Office of Aerospace Medicine's Designee Management System Lead

THE DESIGNEE MANAGEMENT SYSTEM

For more than 50 years, the Federal Aviation Administration has designated qualified individuals to approve certification services on its behalf. The Office of Aviation Safety oversees about 12,000 designees in the Office of Aerospace Medicine, Flight Standards Service, and Aircraft Certification Service to efficiently and effectively serve the public. Designees expand the capabilities of the FAA to accomplish more work than would be possible using only FAA employees; responds to changes in workload and industry needs; demands the highest technical and ethical standards from its designees; and ensures public, congressional, industry, and FAA confidence in aviation safety.

DR. JONES RECEIVES OUTSTANDING MANAGER AWARD

Annual Office of Aerospace Medicine Recognition

Michael D. Jones, MD, Northwest Mountain Regional Flight Surgeon, received the Outstanding Manager of the Year award by the Office of Aerospace Medicine. Each year, the Office of Aerospace Medicine recognizes exemplary employees for their achievements and accomplishments.



Dr. Jones

Other award winners were:

- ★ Flight Surgeon of the Year: **Thomas E. Hatley**, MD, Civil Aerospace Medical Institute
- ★ Regional Employee of the Year (A-G): **Sylvia L. McAllister**, Southern Regional Office
- ★ Regional Employee of the Year (H-M): **Sara Newton**, Central Regional Office
- ★ Office of the Year: **Civil Aerospace Medical Institute**
- ★ Outstanding Leadership Award: **Erin McManus**, Civil Aerospace Medical Institute
- ★ Outstanding Team Award: **Virtual Hiring Team**, Office of Aerospace Medicine
- ★ Administrative Excellence (A-G): **Daniel Outon**, Civil Aerospace Medical Institute
- ★ Administrative Excellence (H-M): **Angela Sauls-Faggins**, Southwest Regional Office
- ★ William E. Collins Publication: **David Weed**, Civil Aerospace Medical Institute
- ★ Mission Support: **Dexter Robbins**, Aeromedical Standards & Policy Branch
- ★ Outstanding Customer Service: **Andrea Robertson**, Southwest Regional Office
- ★ Inspectors of the Year: **Latonya Williams** and **Roy J. Olan**, Miami Drug Abatement Office
- ★ Legal Instrument Examiner: **Ann Ayala**, Civil Aerospace Medical Institute

Federal Air Surgeon Dr. **Jim Fraser** congratulated the award winners at a ceremony via video teleconference April 7, 2015. He said, "They clearly merit recognition for excellent performance. I appreciate their hard work and dedication toward achieving the safety mission and goals of this office." He also acknowledged the "hard work each of you perform every day to make us leaders in the aviation industry. I am proud of everyone in the organization and greatly appreciate your contributions in support of aviation safety."



AVIATION MEDICAL EXAMINER INFORMATION LINKS

Guide for Aviation Medical Examiners
www.faa.gov/go/ameguide

[Register for an AME Seminar](#)

[AME Training Information](#)

[AMCS Online Support](#)

[Regional Flight Surgeon Contacts](#)

[Pilot Safety Brochures](#)

[Multimedia Aviation Medical Examiner
Refresher Course \(MAMERC\):](#)

[Medical Certification Information](#)

[Video Training Topics](#)

[MedXPress Login & Help](#)

[MedXPress Video Page](#)

[FASMB Archives](#)

[CAMI Library Services](#)

SLEEP APNEA INFORMATION (links)

[Frequently Asked Questions](#)

[Sleep Apnea Protocol](#)

[Quick Start Guide](#)

[Specification Sheet A: Information Request](#)

[AASM Tables 2 & 3](#)

[Specification Sheet B--Assessment Request](#)

[OSA Information Brochure](#)

2013 Medical Certification
Statistical Handbook

AVIATION MEDICAL EXAMINER SEMINARS

2015

May 11-14	Orlando, Florida	AsMA (3)
June 8-12	Oklahoma City, Oklahoma	Basic (2)
July 17-19	Philadelphia, Pennsylvania	Refresher (1)
August 31-September 2	Denver, Colorado	Refresher (5)
October 8-10	Fort Worth, Texas	CAMA (4)
October 26-30	Oklahoma City, Oklahoma	Basic (2)
November 20-22	Louis, Missouri	Refresher (1)

NOTES

(1) A 2½-day theme aviation medical examiner (AME) seminar consisting of aviation medical examiner-specific subjects plus subjects related to a designated refresher theme. Registration must be made through the Oklahoma City AME Programs staff, (405) 954-4831, or online through the link on the [AME seminar Web page](#).

(2) A 4½-day basic AME seminar focused on preparing physicians to be designated as aviation medical examiners. Call your Regional Flight Surgeon.

(3) A 3½-day refresher AME seminar held in conjunction with the Aerospace Medical Association (AsMA). This seminar is a Medical Certification refresher, with aeromedical certification lectures presented by FAA medical review officers, in addition to other medical specialty topics. Registration must be made through AsMA at (703) 739-2240. A registration fee will be charged by AsMA to cover their overhead costs. Registrants have full access to the AsMA meeting. CME credit for the FAA seminar is free.

(4) This seminar is being sponsored by the Civil Aviation Medical Association (CAMA) and is sanctioned by the FAA as fulfilling the FAA recertification training requirement. Registration will be through the CAMA Website:

www.civilavmed.com

(5) The Human Intervention Motivation Study (HIMS) seminar. The Pre-HIMS refresher seminar will be the two weekend days immediately prior. This is limited to HIMS participants until we know what our space limitations are.

The Civil Aerospace Medical Institute is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.



OAM PHYSICIANS ON CALL, PART 5

Sleep Apnea Protocol: Easy as 1-2-3

By RICHARD CARTER, DO, MPH

IN PART 1 of this multi-part series, we asked you to help us minimize our backlog of deferred examinations and issue certificates when you can. In Part 2, we provided guidance for more complex cases. Parts 3 and 4 of the series discussed CACI (Conditions AME Can Issue). All of this provides more opportunities for you to make significant contributions to the Federal Aviation Administration medical certification process.

Results

These changes have made a difference. We see less of a backlog of deferred cases as CACI and other measures help to improve the certification process. Aviation medical examiners (AMEs) have really stepped up their game and helped us to minimize delays.

Issue When You Can

The theme of this series, *Issue When You Can*, continues with the new Sleep Apnea Protocol [see Protocol in the Guide for Aviation Medical Examiners—[Obstructive Sleep Apnea \(OSA\)](#)]. The new Protocol provides guidance, with an emphasis to conduct the triage for sleep apnea risk assessment, and issue the medical certificate whenever possible. Only rarely, do we expect you to defer.

Inauguration Day



Tha author (left) and Dr. Johnson field calls from AMEs during the first day of the obstructive sleep apnea protocol.

At 8:01 a.m., March 2, 2015, on time and without any (computer) glitches, the online *Guide for Aviation Medical Examiners* (AME Guide) launched the OSA Protocol in its Protocol section. Simultaneously, the Aerospace Medical Certification Subsystem online support launched—two successful launches within seconds of each other—creating the new sleep apnea triage system. Dr. **Brian Johnson**, acting Aerospace Medical Certification Division supervisory physician, and I, were ready when the first aviation medical examiner called. To document the event, a photo was taken during that call.

The questions from AMEs that morning had a common theme [see link, [Frequently Asked Questions \(FAQs\)](#)]. “What is it I have to do?” The important message was to issue, and not delay, certification. I advised the examiner to refer to the Sleep Apnea Protocol Quick Start Summary [see [Quick-Start for AMEs](#)].

Quick Start

The following is a brief review of what Quick Start says and what the phone calls from AMEs represented. Our approach—think of the Quick Start—as “**easy as 1-2-3**,” the essential elements of what the Sleep Apnea triage requires.

1 Issue, if otherwise qualified. This is important. One AME asked, “The airman has been using a continuous positive airway pressure (CPAP) device for many years, not previously reported, and I still, just regular issue?” Yes, regular issue, and click the Group 2 button (radio icon) and transmit. Give the airman Specification Sheet A [see [Specification Sheet A - Information Request](#)], and advise that a letter will be sent from the Aerospace Medical Certification Division (AMCD) requesting additional information. That Group 2 button really works! The AME faxed in reports the same day, and the case automatically routed to an AMCD reviewer (Legal Instrument Examiner). The sleep apnea AASI (AME Assisted Special Issuance) letter and a new time-limited certificate for that airman were completed within 24 hours, thanks to that AME’s diligence.

Another caller asked, “When do I defer?” My answer was “rarely.” I advised him to defer for very high risk only. For example, if the airman falls asleep in your office or voices significant concerns (see case example 2). While some airmen may not volunteer their symptoms, consider the risk factors we encounter in pilots, such as hypertension (refractory, two or more medications), atrial fibrillation, and conditions requiring metformin. When you see this in an airman with a body mass index (BMI) greater than 35, you should certainly advise counseling and consultation. However, the BMI, alone, cannot be the criteria for determining sleep apnea risk.

None of the calls that first day required us to advise a deferral. When airmen were identified as having high sleep apnea risk, we did usually advise the AME to issue the certificate, and give the airman Spec Sheet B to obtain the appropriate consult.

2 “Document findings in Block 60 (Item 60).” The Quick Start Guide states notation of your disposition is needed. If you select Group 5 (At risk, sleep apnea assessment required), we need to know why. You have some latitude here. There is no specific wording required for block 60. Suggestions:

- » Item 3, Not at risk for OSA – “does not meet Table 2, Table 3 criteria”
- » Item 5, Not at risk for OSA – “BMI 31, atrial fibrillation, diab/metformin, hypertension”

Continued →

Notice the wording suggested does not say, “meet/not meet certification criteria for sleep apnea.” Put another way, sleep apnea is not a Worksheet condition (see CACI). Rather, we advise reference to Table 2, Table 3 [see [AASM Tables 2 and 3](#)], prominently displayed in the AME Guide OSA Protocol.

Tables 2 and 3 are easily referenced and allow you to quickly sum up risk factors. We do rely on you, the AME, to advise us if further evaluation is needed. That further evaluation does not require a sleep specialist, but we need more than just another triage. Should the applicant be determined to be in Group 5, the airman still gets issued! Give the airman Specification Sheet B [see [Specification Sheet B - Assessment Request](#)] and advise that the AMCD will send the applicant a letter requesting additional information. The letter will state the applicant has 90 days to provide the report.

3 Provide resources and educational information, as appropriate (Group 4). No specific literature is required, but the AME Guide provides references and resources [see Supplemental and Educational Information, [FAA OSA Brochure](#)]. You do not have to require every airman to fill out a questionnaire form about sleep apnea.

Case Example 1

First-class airman, wife reporting snoring (Table 3 criteria), BMI 26, no other medical conditions such as hypertension, atrial fibrillation, diabetes (Table 2 criteria). After discussing with the airman, the AME provides educational materials and issues, selects Group 4 (applicant may be at risk). Summarize history in Block 60. AME does regular issue, if airman is otherwise qualified. The AME does not need to call the AMCD prior to transmitting exam.

Case Example 2

Third-class airman, age 74, reports no symptoms, no medications, no remarkable medical history. His BMI is 35, but his AME notices irregular heart rate, advises cardiology consultation, which was done immediately. The cardiologist reports atrial fibrillation, leg swelling, possibly due to pulmonary hypertension as a result of untreated sleep apnea. Testing includes echocardiogram, indicating apical akinesis; poor exercise tolerance on stress testing; radionuclide finding of “small mid-anterior scar.” Further evaluation and treatment advised.

“The airman has an elevated BMI and irregular heartbeat, which on ECG confirmed atrial fibrillation. The airman was referred to a cardiologist the same day. The airman was completely asymptomatic.”

After discussing with the airman, the AME selects Group 6 (Immediate Safety Risk) and defers exam. The AME summarizes in block 60 – “The airman has an elevated BMI and irregular heartbeat, which on ECG confirmed atrial fibrillation. The airman was referred to a cardiologist the same day. The airman was completely asymptomatic.”

Easy as 1-2-3: Review

Our approach—derived from many conversations with AMEs—is to think three steps for sleep apnea assessment:

1. *Issue, if otherwise qualified.*
2. *Document findings in Block 60 (use Table 2, Table 3 for reference).*
3. *Provide resources and educational information, as appropriate.*

Team Effort

We need your help to reduce unnecessary deferrals and certification delays. Many complex medical conditions do eventually get a special issuance. Together, we can expedite the medical certification of pilots.

Stay Tuned. In Part 6 of this series, we will discuss more conditions and aeromedical dispositions to keep your airmen flying safely.



Dr Carter is a medical review officer in the Aerospace Medical Certification Division.

NEUROCOGNITIVE DECLINE IN A RECREATIONAL PILOT WITH OBSTRUCTIVE SLEEP APNEA

CASE REPORT, BY RUSSELL C. TONTZ, III, MD, MPH

Obstructive sleep apnea (OSA) has been long recognized as having the potential for long-term cardiovascular effects for airmen. However, more focus should be on the detrimental effects OSA may have on the neurocognitive functioning of the airman and the potential consequences to aviation safety if left unrecognized and not controlled.

History

A 42-YEAR-OLD MALE CLASS-3 pilot presents to his aviation medical examiner upon recommendation from his family physician. The pilot works as a construction engineer for a busy commercial construction firm. Over the past month, his colleagues have noticed that he is less decisive in his decision-making and has displayed more forgetfulness. The applicant admits that he is drinking more coffee to stay awake throughout the day and that he is not as “sharp” as he usually is at work. He owns a Piper Warrior and has flown it 200 hours since obtaining his Class-3 certificate five years ago. However, he has not flown in the past six months due to increased work demands.

The pilot’s only other reported health condition is that he is overweight. He denies any history of smoking or illicit drug use and reported minimal alcohol use. His physical exam was benign—other than a BMI (body mass index) of 32 and a neck circumference of 17 inches. An office MMSE (Mini Mental Screening Examination) was within normal limits. An Epworth sleepiness scale given in the office was 15.

Upon further questioning regarding his sleep behavior, the applicant admits that his wife has mentioned that he has always snored quite loudly. He says that he wakes up at night for unknown reasons and feels tired in the morning, although he tries to get eight hours of sleep every night. His family physician, who has known him since a child, notices an obvious difference in his personality and, knowing he is a private pilot, asks that he be evaluated by his AME.

Aeromedical Concerns

This individual needs to be evaluated for obstructive sleep apnea because he has risk factors such as elevated BMI, neck circumference, and elevated Epworth Sleepiness scale scores.¹ He admits to having poor sleep and resultant daytime somnolence, which is a clear risk to flight safety. His forgetfulness may be the result of his OSA and the resultant chronic intermittent hypoxia.

The FAA will consider each case on an individual basis, in consultation with a specialist, after an overnight polysomnography (PSG) is obtained. The American Academy of Sleep Medicine recommends that portable monitoring can be used as an alternative to the gold standard PSG, when the patient has a high pre-test probability of moderate-to-severe OSA. The documentation of treatment and treatment response is also necessary for the FAA to medically certify.

In this case, the PSG showed severe sleep apnea, and the sleep specialist recommended not only CPAP but also neurocognitive testing, based on the airman’s complaints of forgetfulness. The

neurocognitive test showed verbal and spatial deficits below average for the airmen’s age and level of education. No baseline tests were available to compare the current findings with, but the results were consistent with research that suggests links between OSA and neurocognitive changes.²

Outcome

The Regional Flight Surgeon disqualified the airman for any class of medical certificate and requested that he promptly surrender his unexpired medical certificate. The case was reviewed by the Aerospace Medical Certification Division (AMCD), and they recommended that the airmen be treated with continuous positive airway pressure, based on the recommendations from the sleep specialist. Repeat PSG and neurocognitive testing were to be done in six months. The repeated tests showed much improvement, as did the airman’s symptoms. The AMCD determined that his condition was compatible with aviation safety and that he was eligible for a third-class airman medical certification under the provisions of an Authorization for Special Issuance of a Medical Certificate, as this applicant has a medical condition that is disqualifying under Title 14 of the Code of Federal Regulations (14 CFR) part 67.

Discussion

The most common medical cause of excessive daytime sleepiness is obstructive sleep apnea.¹ OSA is a common sleep disorder, affecting at least 2 to 4% of middle-aged individuals.² OSA is characterized by the repetitive complete or partial collapse of the upper airway during sleep. Collapse of the upper airway causes cessation (obstructive apnea) or a significant reduction (obstructive hypopnea) of airflow.³ In career fields like aviation, the risk of excessive daytime sleepiness not only affects the individual but also affects the safety of the general public.

Numerous sleep disorders are classified within the broad category of sleep-disordered breathing. All of these syndromes are characterized by the cessation or partial cessation of airflow, causing multiple arousals from sleep. Obstructive sleep apnea syndrome is the most common type of sleep apnea and presents, together with central sleep apnea, the most severe sleep-disordered breathing condition (caused by an obstruction of the upper airway).⁴ The severity is usually determined by the respiratory disturbance index, which is the sum of the number of apneas and hypopneas per hour of sleep. An apnea is a cessation of airflow, and a hypopnea is a 30% to 50% reduction in airflow during at least 10 seconds.⁴ Since its introduction in 1981, positive airway pressure has been the most efficacious therapy and is often the first option for OSA patients.

Continued →

Chronic, untreated OSA is an independent risk factor for hypertension, diabetes, stroke, and cardiac rhythm disturbances, along with the higher risk of occupational injury and lost work productivity.⁵ The cardio-metabolic abnormalities in OSA are believed to be the consequence of intermittent hypoxia and sleep fragmentation, which promote atherosclerosis through increased sympathetic drive, oxidative stress, and inflammation of the vasculature.³

Besides the known cardiovascular complications of uncontrolled OSA, neurocognitive impairment may also be present. This neurocognitive impairment seen in OSA is due to the adverse effects of sleep fragmentation and/or intermittent hypoxia, and it remains unclear whether cognitive deficits return to normal after OSA treatment.¹ Patients with severe OSA may experience hundreds of respiratory disturbances per night, resulting in extreme sleep fragmentation.⁴

The clinical pathology of the intermittent hypoxemia associated with sleep apnea syndrome and the apnea of prematurity suggests that there may be long-term adverse consequences of chronic cyclical hypoxia.⁶ Besides the known risk for hypertension, coronary and cerebral vascular disease, some researchers suggest that persistent bouts of hypoxia may result in residual neurocognitive effects of OSA such as verbal and spatial executive deficits that may occur in individuals with severe OSA, despite treatment and normalized sleep.⁷

A meta review by Bucks et al. supports the presence of relationships between attention/vigilance dysfunction and sleep fragmentation, and between hypoxemia and global cognitive function.¹ A significant decrease in overnight verbal memory consolidation is noted in patients with OSA, compared to healthy subjects.⁸ Furthermore, treatment of OSA with continuous positive airway pressure appears to improve executive dysfunction, delayed long-term verbal and visual memory, attention/vigilance, and global cognitive functioning.¹

Canessa et al. demonstrated not only neuropsychologic impairments in memory, attention, executive functions, and constructional abilities, but also associated decreases of gray-matter volume in specific cerebral regions.² After three months of treatment, they observed a significant improvement in all cognitive domains, as well as an increase of gray-matter volume in specific hippocampal and frontal brain regions. In the study by Canessa et al., true structural brain changes related to OSA and its reversibility with proper treatment may be a

motivating factor for compliance with treatment goals. These changes are significantly correlated with improvement in specific neuropsychologic tests (executive functioning and short-term memory), underlining the importance of early diagnosis and treatment of sleep apnea.²

Conversely, Verstraeten suggests that this increased cerebral response is more consistent with the adaptive compensatory changes following total sleep deprivation and not necessarily structural prefrontal brain damage.⁴ Although nocturnal hypoxemia may eventually result in neuronal damage or injury in severe OSA that remains untreated for a long period of time, there is no solid scientific basis today to suggest the presence of irreversible brain lesions in OSA patients as a group.

Most would agree that early detection and treatment of OSA is important to prevent or stop the cardiovascular consequences of this disorder. Further research to better determine the underlying mechanisms needs to be promoted. The risk of neurocognitive decline should be emphasized to all OSA patients so as to increase their motivation for compliance to improve their quality of life.

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OBSTRUCTIVE SLEEP APNEA WITH CHEYNE-STOKES RESPIRATIONS IN AN AIR TRANSPORT PILOT

CASE REPORT, BY AJIRI IKEDE, MD, MPH

Obstructive sleep apnea (OSA) has an estimated prevalence of 2-25% in adults and has a strong association with obesity. With the ongoing rise in obesity rates, it stands to reason that an increasing number of aviators may be at risk of developing OSA. This article presents the case of an air transport pilot with moderate sleep apnea.

Case Presentation

A 52-year-old commercial airline pilot and flight instructor with approximately 15,000 flight hours presented to his aviation medical examiner to renew his medical certificate. The pilot's medical history was significant for mild seasonal allergies, acid reflux, mild myopia, and slightly elevated cholesterol, none of which was disqualifying. Thus far in his career, the applicant had always received clear medical certificates. He was also seen by a neurologist for a voice tremor and was successfully treated with Botox. However, the details of this medical issue and treatment were not on his Federal Aviation Administration (FAA) medical file.

During his most recent FAA exam, the airman reported that his weight has been slowly increasing over the last few decades. A review of his records showed that he had indeed gained 50 pounds since his initial certification 30 years ago. On physical exam, he was found to have a body mass index of 31 and neck circumference of 18 inches. Given his risk factors for sleep apnea, the aviation medical examiner (AME) initiated screening of detailed sleep history in search of any associated signs and symptoms of sleep apnea.

The airman denied any episodes of falling asleep or feeling overly drowsy while flying, but he did report feeling more fatigued than usual. His wife had informed him that he sometimes has pauses in his breathing while sleeping. With a history and physical exam highly suggestive of obstructive sleep apnea, the AME deferred the certificate to allow time for further investigations. The airman completed polysomnography (PSG) that showed an apnea/hypopnea index (AHI) of 20.5 with both central and obstructive events, consistent with a diagnosis of moderate complex sleep apnea with Cheyne Stokes breathing pattern.

The lowest oxygen saturation recorded during PSG was 89%. A trial of continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP) reduced the obstructive events but did not effectively treat the central apneic events. He was subsequently treated with auto servo ventilation, with favorable results, reducing his AHI to less than 6, and perhaps most importantly, eliminating his symptoms of fatigue.

ETIOLOGY & MANAGEMENT OF OBSTRUCTIVE SLEEP APNEA

Obstructive sleep apnea is defined as a periodic reduction or cessation of airflow as a result of narrowing of the upper airway, resulting in disruptions of normal sleep patterns, as well as poor oxygenation during sleep. The prevalence of OSA in adults is estimated to range from 2% to 25%.^{1, 5} Furthermore, a strong link between obesity and OSA has been demonstrated.^{1, 2, 4, 6}

The diagnosis of OSA is based on a history, physical examination, and screening tests, of which polysomnography is the gold standard. Symptoms of OSA include daytime sleepiness, non-restorative sleep, morning headaches, sore throat, decreased memory function and concentration. Risk factors for OSA include obesity, hypertension, polycythemia, large neck circumference, snoring, and witnessed apneas while sleeping.⁴ Cheyne-Stokes respiration (CSR) is a form of central sleep apnea that can be associated with OSA and demonstrated during a sleep study. CSR is defined as a lack of central respiratory drive, characterized by cycles of waxing and waning respiratory efforts, followed by periods of no breathing efforts.³ All forms of sleep apnea result in decreased oxygenation and fragmented sleep and are associated with long-term complications, which include hypertension, heart disease, and stroke.

Once a diagnosis of OSA has been confirmed by a PSG showing an AHI of >5, appropriate treatment should be initiated. For mild OSA (i.e., AHI of 5-15), behavioral changes such as weight loss and avoidance of sedatives may be sufficient to resolve symptoms. Oral appliances that help to reposition the upper airway are also indicated in the treatment of mild-to-moderate OSA (i.e., AHI <30). In cases of severe or refractive OSA, positive airway pressure treatment is indicated.¹

Continuous positive airway pressure (CPAP) is the most common treatment of obstructive sleep apnea. This therapy maintains a patent upper airway by providing a constant pressure during both inspiration and expiration. Bilevel positive airway pressure (BiPAP) provides assistance during inspiration by creating a pressure in the airway that is above that of which would help maintain a patent airway. During the expiration phase, the BiPAP essentially functions in the same way as CPAP. Auto servo ventilation (ASV) is similar to BiPAP, with an important distinction. ASV has the ability to detect decreases in respiratory effort, as seen in central apneas. When this occurs, the ASV system not only maintains the patency of the airway like CPAP and BiPAP but is also capable of maintaining a respiratory rate until the spontaneous respiration resumes.

The treatment goal for all patients with sleep apnea is a reduction of AHIs and complete resolution of symptoms. The efficacy of treatment, as well as compliance, can be determined by reviewing the recorded information on the positive airway pressure devices.

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Aeromedical Concerns

This airman has moderate sleep apnea that is being successfully treated with auto servo ventilation. Sleep apnea is disqualifying under Title 14 of the Code of Federal Regulations part 67 due to risk of acute incapacitation from excessive somnolence. However, this airman may qualify for an AME assisted special issuance. Once authorized for special issuance, an AME may re-issue a medical certificate, provided that a current report from the airman's treating physician clearly indicates compliance with treatment and no symptoms of sleep apnea. If there are any issues about response or compliance, a maintenance of wakefulness test will be required.

Outcome

The documentation regarding sleep apnea diagnosis and treatment was reviewed by an FAA respirologist. This airman was able to document compliance as well as successful response to treatment of his sleep apnea, thereby qualifying for a Special Issuance. However, his medical certification remained deferred to allow more time to gather more information about the medical care he received from the neurologist.

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SEIZURES IN A SLEEP-DEPRIVED AIRMAN

CASE REPORT, BY JOHN E. MILES, MD, MPH

The relationship between sleep deprivation and seizures has been long recognized. Lack of sleep, especially when combined with emotional stress, malnutrition, and heavy alcohol intake likely lowers the threshold for seizures in both known epileptics and normal individuals. This article describes the case of a 33-year-old airline pilot who experienced his first seizure while profoundly sleep-deprived.

History

A 33-year-old male first-class airman with 3,500 hours of flight time was talking to a crewmember while piloting a flight when he suddenly became disoriented. His co-pilot noted that the airman was staring straight ahead and would not respond to questions. After being shaken by the copilot, the airman gradually recovered. He reported that he was somewhat confused for several seconds and did not initially recognize his surroundings, but he then quickly returned to normal. No abnormal motor activity was observed, and the airman did not experience incontinence. Because of a hectic schedule and poor sleep, he attributed this episode to fatigue. He grounded himself and sought medical attention. His primary care provider advised rest.

Two weeks later, the pilot was on vacation, sitting beside a pool, when he experienced a similar episode. He became slightly confused, thinking that the scenery had changed, and he did not recognize anyone or know his whereabouts. The airman described losing awareness and experiencing difficulty focusing. This episode lasted for about 30 seconds. A third and final, essentially identical, episode occurred about one week later. The airman reported that all three episodes had occurred without warning. He denied any abnormal tastes or smells prior to these episodes, but he did feel that one or two of the episodes may have been preceded by a headache.

The airman was referred to a neurologist for further evaluation. He underwent an electroencephalogram and magnetic resonance imaging of his brain. Both tests were normal. His medical history was essentially negative. He had no history of head injuries, unexplained losses of consciousness, or meningitis. He reported occasional headaches but denied any difficulties with memory or decline in mental activities. He reported no visual loss or diplopia and had normal hearing, smell, and taste. He denied paresthesias or weakness. He was taking no medications, smoked approximately a half-pack of cigarettes daily, and denied consuming any alcohol.

The airman did report significant life stressors that contributed to his recent extreme fatigue. He had been experiencing marital difficulties, complicated by a career that required him to be away from home for extended periods of time, and he was now involved in a divorce and custody battle for his children. Long cross-country commutes in order to fly for three to four days left him feeling extremely exhausted. He reported obtaining only two to three hours of sleep nightly and was eating erratically and poorly, especially while traveling.

ETIOLOGY

SLEEP DEPRIVATION AND SEIZURES

Since at least the time of Hippocrates, physicians have recognized a relationship between seizures and sleep. Researchers in the 1960s and 1970s confirmed that sleep deprivation may provoke seizures in known epileptics.⁴ Between 18 and 38% of patients with epilepsy reported sleep deprivation as being a trigger for their seizures.⁵

Other studies have found that profound sleep loss can trigger convulsions, even in normal subjects. One case series published in 1964 described three pilots who had experienced their first seizure while profoundly sleep-deprived, poorly nourished, and experiencing work-related stress. Additional studies in sleep-deprived military personnel have found significantly higher rates of seizures than in similar non-sleep-deprived populations.⁵

In fact, the risk of seizure may be as high as 1/10,000 after 24 to 36 hours of total sleep deprivation, and this risk increases to 1/2,500 after two or more days without sleep. This tendency towards seizures in the sleep-deprived does not even require prolonged periods without any sleep. Simply shortened or interrupted sleep periods may accumulate over time and contribute to chronic fatigue, which has also been demonstrated to lower the threshold for seizures in both known epileptics and normal individuals.⁵

No abnormalities were noted on examination. Cranial nerves were intact. Romberg, finger-to-nose, and heel-to-shin tests were normal. No pronator drift was observed. Touch, pain, vibration, and proprioception were normal in the extremities and trunk. Gait was normal.

The neurologist diagnosed the airman as having experienced complex partial seizures, likely precipitated by his recent sleep deprivation. The airman was started on Depakote (divalproex sodium), which he took as directed for four to six weeks but then stopped due to weight gain. He was switched to Topamax (topiramate), which he took for five to six weeks but then discontinued it, against his neurologist's advice.

Aeromedical Issues

In accordance with Title 14 Code of Federal Regulations (CFR), Sections 67.109(a)(b), 209(a)(b), and 309(a)(b), an established medical history or clinical diagnosis of epilepsy is disqualifying for all flying classes. Other seizure disorders, disturbances of consciousness, or neurological conditions may also be deemed disqualifying if they make a person unable to

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safely perform his or her duties. Although brief in duration, complex partial seizures such as those experienced by this airman pose a significant hazard to aviation safety. Such seizures may incapacitate an airman during critical phases of flight, and they also have the potential to generalize or progress into status epilepticus, incapacitating the airman for extended periods.¹

Role of the AME

In accordance with the *Guide for Aviation Medical Examiners*, a history or the presence of any neurological condition or disease that potentially may incapacitate an individual should be regarded as initially disqualifying. As detailed above, epilepsy and other seizure disorders are specifically disqualifying for all flying classes. Issuance of a medical certificate to an applicant in such cases must be denied or deferred, pending further evaluation.²

Prior to consideration for an airman medical certificate, an applicant with a diagnosis of epilepsy must be seizure-free for 10 years, and be off anticonvulsant medications for at least three years. This requirement applies to all types of seizures. After the 10-year period of being seizure-free, a full neurological evaluation with EEG is required.³

If an airman experiences only a single seizure, certification requirements are somewhat less stringent. If the single seizure is determined to be secondary to a known pathological condition, and the cause has been corrected, an applicant may be considered for an airman medical certificate after as little as a one-year recovery period. A neurological evaluation will be needed prior to the issuance of a medical certificate, but no follow-up is required.³

An unprovoked single seizure, with no satisfactory medical explanation, usually requires a four-year recovery period with at least two years off of all anticonvulsant medications. In addition to a complete neurological examination, a current EEG, CT, or MRI scan of the brain may be required prior to consideration for medical certification.³

Outcome

This airman was notified that his most recent report of medical examination had expired for the class of certificate for which he applied. He was informed that if he were to submit a current examination, the FAA would have no alternative other than to deny his eligibility for medical certification. The airman may apply for a special issuance after completing the 10-year seizure-free period and the additional requirements detailed above.

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