

Diagnosis and treatment of 2 cases of sleep disorder in military flight personnel and the aeromedical identification

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Research Article

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Abstract

Objective To explore the diagnosis, treatment and aviation medical identification of sleep disorders in flight personnel.

Methods All methods are performed in accordance with the relevant guidelines. The diagnosis, treatment and aviation medical identification of 2 cases of flight personnel with sleep disorders were retrospectively analyzed and the related literatures were reviewed.

Results An air mechanic (case 1) expressed abnormal behavior during sleep. The video electroencephalogram monitoring showed episodic abnormal behavior that was manifested involuntary movement of limbs (obviously on the right side) and flapping action in his first admission examination. Synchronous electroencephalogram showed a large number of electromyography motion artifacts throughout the whole course, and a few scattered suspicious spiky waves were observed in the right temporal region during the interictal period. Polysomnography (PSG) indicated abnormal sleep behavior, confusional arousals. No more obvious abnormality was found by PSG and video electroencephalogram when the reexaminations conducted. Case 2 was a bomber pilot with lower extremities discomfort, difficulty in falling asleep and easy to wake up at night. Restless legs syndrome was diagnosed according to the patient's symptoms, PSG, braking test, response to treatment and exclusion of other possible causes of the symptoms. The symptoms disappeared by treatment. Both cases were qualified for flight.

Conclusion Abnormal sleep of flight personnel is rarely reported. The relevant personnel, such as aviation doctors should raise awareness of abnormal sleep among flight personnel. According to the clinical symptoms and related examinations of the pilots, diagnosis and treatment should be made as soon as possible, and individualized diagnosis, treatment and identification should be carried out according to their responsibilities and curative effects.

Introduction

Abnormal sleep refers to disturbances in the quantity, quality, timing and rhythm of sleep. There are many reasons for abnormal sleep, including changes in physiological, psychological, environmental and other factors, as well as drugs, psychosomatic diseases, etc. Abnormal sleep and related diseases can induce more serious physical and psychological diseases if not dealt with and adjusted in time. Abnormal sleep includes abnormal sleep behavior, sleep movement disorder, sleep apnea syndrome, etc. ^[1]. Abnormal sleep can seriously affect the body and mind of flight personnel, which is closely related to flight safety and should be paid attention to. The author reports 2 cases of flight personnel suffering from rare types of sleep disorders, and reviews the relevant literature to improve the understanding of such diseases and provide references for their diagnosis, treatment and medical identification .

Clinical Information

Case 1, male, 41 years old, air mechanic of Hongyunjiao-7, flight time of 3800 hours. Paroxysmal sleep behavior disorder for more than 1 year, intermittent ventricular pre-shock was detected in May 2016, and underwent intracardiac electrophysiological examination + radiofrequency ablation in the Department of Cardiology of the former Air Force General Hospital (Air Force Special Medical Center) in September 2016. There was no obvious discomfort after the operation, but there was occasional chest tightness. On December 6, 2019, the patient's wife found that she held her hands in front of her chest during sleep, and then turned back and forth on the bed, her eyes were closed, there was no tongue bite or foaming at the mouth, No bowel movements and urinary incontinence, and the symptoms lasted for several minutes. After waking up, the patient felt headache, chest tightness, and had no memory of the disease process. On December 23, 2019, he was admitted to the 962nd Hospital of the People's Liberation Army. At about 3:00 am on the 24th, a patient in the same ward found that he suddenly spoke during his sleep, then sat up, scratched his legs, and had a painful facial expression, which lasted for about 1 minute; then he took off his clothes and went to the bathroom. After urinating, he returned to the bed and patted his legs, At the same time his hands and feet moved erratically; after that, the patient had abnormal behaviors such as shouting, patting the legs, and knocking on the bed several times during sleep. No abnormality was found in the head MRI and MRA on the next day. EEG showed mild abnormalities, and occasional suspicious small sharp waves were seen in the frontal pole between interictal period. On January 2, 2020, he entered the Department of Neurology of the Air Force Special Medical Center, He said that he had poor sleep for a long time and was easy to wake up. Physical examination showed no obvious positive signs. After entering the department, there were leg slaps, sighs, and finger snaps during sleep, which lasted for about 5 to 10 s, and could not be recalled after waking up. The 24-hour video EEG showed episodic abnormal behavior, manifested as involuntary movement of limbs, and slapped movements; synchronous EEG showed: a large number of EMG motion artifacts in full-lead, and a small amount of scattered suspicious small sharp waves in the right temporal region during the interictal period. polysomnography(PSG) showed that there were abnormal behaviors such as slapping, scratching the thighs and calves, sighing and snapping fingers, mainly in the N1 and N2 stages of non-rapid eye movement (NREM), No obvious epilepsy was found before and after the onset, and intermittent ventricular pre-shock waves were occasionally seen on the ECG. Diagnosis: Temporarily considered paroxysmal sleep behavior abnormalities, confusional arousal. Aviation medical appraisal conclusion: temporarily unqualified for flight.

The doctor instructed him to maintain a healthy lifestyle, including regular work and rest, relax and instruct him to observe whether he still has abnormal sleep behavior after discharged from the hospital. In June 2020, he returned to the hospital for re-examination, and there was no abnormal behavior during sleep. Re-examination video EEG showed occasional atypical spikes in bilateral temporal regions during sleep. PSG showed that no abnormal EEG activity was found throughout the night; no significant increase in mandibular EMG and lower extremity EMG was found in the rapid eye movement (REM) period, and no abnormality was found in the synchronized audio and video in the REM period. Aviation medical appraisal conclusion: temporarily unqualified for flight. Later, he was admitted to the Air Force Special Medical Center for re-examination in September, December 2020 and March 2021, and there was no

abnormal behavior during sleep. 24-hour video EEG was normal. PSG showed: no abnormal brain electrical activity and abnormal behavior were seen throughout the night. Epilepsy was ruled out, and the definitive diagnosis was paroxysmal sleep behavioral disorder, confusional arousals. The patient had no more abnormal sleep behaviors for more than 1 year, and no other diseases affecting flight were detected. Aviation medical appraisal conclusion: the flight is qualified. After more than half a year of follow-up, no abnormality was found.

Case 2, male, 31 years old, bomber pilot, flight time 730 hours. He complained of episodic soreness and discomfort in both lower extremities during the night with difficulty falling asleep and waking up easily for 3 years, which worsened for 1 year. Since 2012, the patient suffered from soreness and discomfort in both calves without obvious incentives, accompanied by paresthesia, like ant walking, worm crawling, and occasional intermittent tingling. Most of them appear at night before falling asleep and during sleep, which affects sleep. It can be relieved after getting out of bed and walking, massaging or tapping lightly. Frequent awakenings at night. In 2014, the above symptoms of the patient became worse than before. When the symptoms appeared, he felt unbearable, involuntary shaking and unable to fall asleep. Relief after getting out of bed for repeated activities or massage, and reappearing after lying down. The patient's mother has restless legs syndrome in the family. The patient went to the hospital called the Air Force General Hospital in May 2015, and no obvious positive signs were found in the physical examination. Blood routine, biochemical function, thyroid function, tumor markers, folic acid + vitamin B12 were normal; no obvious abnormality was found in electromyography + somatosensory evoked potential, abdominal CT, and lumbar MRI. PSG report: increased sleep in N1, decreased sleep in N3, slightly decreased sleep in REM, and the lowest blood oxygen saturation in sleep was 90%. Limb movements were characterized by leg movement during the static braking test. No psychological disorder was found in the consultation of the medical psychology department. Trial pramipexole hydrochloride is effective. Combined with the patient's positive family history, symptoms and the effectiveness of pramipexole, the diagnosis was restless legs syndrome (RLS). Aviation medical appraisal conclusion: temporarily unqualified for flight. In January 2016, he returned to the hospital for re-examination, which was better than before, and the flight conclusion was the same as before. After returning to the hospital for re-examination 6 months later, the above symptoms disappeared, the drug has been stopped, no other diseases affecting the flight were found, and the patient is confident in returning to the flight. Aviation medical appraisal conclusion: the flight is qualified (Two-seater was initially restricted, but the restriction was lifted after half a year). The above symptoms did not recur during the annual follow-up.

Discuss

Sleep is divided into wakefulness, NREM and REM. The NREM stage can be further divided into N1 stage, N2 stage and N3 stage. Normal sleep is periodic, and NREM/REM sleep cycles generally occur 3 to 5 per night^[2]. Some of the abnormal behaviors that occur during sleep have received much attention as the disease is better understood. However, it is easy to be misdiagnosed due to atypical clinical manifestations^[3]. Various types of abnormal sleep behavior become increasingly prominent with the

accelerated pace of life. Abnormal sleep is common in ordinary people, but rare in pilots. Therefore, the author discusses the following aspects and conducts relevant identification and analysis based on the above cases.

The diagnosis and differential diagnosis of sleep disorders

1. confusional arousals

(1) Definition and classification Parasomnia refers to a variety of unpleasant physiological events or experiences that occur when falling asleep, during sleep, or waking up from sleep ^[4]. The International Classification of Sleep Disorders Third Edition (ICSD-3) ^[1] divides them into three categories, including NREM sleep disorders, REM sleep disorders, and other sleep disorders. NREM sleep abnormalities are divided into arousal disorders (including confusional arousal, sleepwalking, and sleep terrors) and sleep-related eating disorders ^[5-6]. The clinical manifestations of NREM sleep abnormalities are diverse, all occur in the junction between wakefulness and sleep, and the behavior is more similar to the wakeful state ^[7]. Among them, confusional arousal is usually manifested by simple behaviors, such as tossing and moving in bed, making noises, or crying.

(2) Diagnostic criteria: Repeated mental confusion or disorganized behavior during awakening from nighttime or daytime naps or during awakening. These phenomena cannot be more reasonably explained by other sleep disorders, mental disorder drugs, or drug abuse ^[1]. The patient of case 1 is close to being awake in behavior, but has a vague consciousness; the manifestations are diverse, without rigidity repetition violence and other behaviors, without panic, fear and other features of autonomic hyperactivity, excluding other diseases, drug abuse, etc., Diagnosis consistent with paroxysmal sleep behavior disorder. It has been reported in the literature that abnormal sleep behavior in NREM is a common disease and an important cause of sleep disruption and sleep-related disorders ^[8]. However, there are few reports in my country, which may be related to the lack of awareness of this disease. confusional arousals are not necessarily pathological. Medications, sleep deprivation, and other sleep disorders may cause confusional arousals. Abnormal circadian sleep-wake patterns or excessive sleepiness are characteristic of abnormal sleep ^[7] .

(3) Differential diagnosis: epilepsy is characterized by paroxysmal, transient, repetitive, and stereotyped. Nocturnal frontal lobe epilepsy (NFLE) is a focal epilepsy that occurs primarily during sleep. Diagnosis mainly relies on medical history and video EEG recordings during seizures ^[9], However, the medical history is the main basis for diagnosing epilepsy. NFLE has more frequent (monthly episodes), similar presentations, and multiple episodes a night, whereas NREM sleep disorders are less frequent and may vary from night to night. NFLE episodes generally last no more than 2 minutes, However, sleep disorders last from a few seconds to 30 minutes. Extrapyramidal symptoms such as stiffness and dystonia can occur in NFLE, but are extremely rare in sleep disorders ^[10-11]. Although a small amount of suspicious small sharp waves were seen in the EEG of case 1, such discharges can also be recorded in the EEG of

some normal people. Moreover, the patient did not experience any further abnormal sleep behaviors 1 year after discharge without taking any medication, therefore, the diagnosis of epilepsy was ruled out.

REM sleep behavior disorder (RBD) is characterized by dystonia during REM sleep, accompanied by violent dream-playing behaviors, namely dream states^[12-13]. Usually occurs 3 to 4 times a week. The important features of RBD are: persistent or multiple transient increase in the electrical excitability of the chin electromyography, or multiple phasic twitches of the chin, upper and lower limbs, and a dream state. In case 1, the mandibular EMG and lower extremity EMG did not increase significantly in REM stage, and there was no abnormality in synchronous audio and video in REM stage.

Confusional arousals usually do not require medication. The patient was cured clinically by changing his lifestyle, including the regularity of work and rest, relaxing his mood, and moderate decompression.

2. RLS

(1) Definition and classification RLS refers to indescribable paresthesia and discomfort in both lower extremities at night or in a resting state, as well as a strong desire to move both lower extremities; Frequent lower extremity activity or tossing and turning of the trunk during sleep, symptoms relieved after activity, and reappears after cessation of activity. This is a common neurological sensorimotor disease that significantly affects patients' sleep and quality of life^[14-15]. RLS has the characteristics of low diagnosis and low treatment, and has a clear circadian rhythm trend, which is aggravated in the evening, night or quiet, and the symptoms are relatively mild during the day. Sleep disruption caused by RLS may lead to anxiety, depression, somatization disorders and other psychiatric symptoms^[16-17]. Because it seriously interferes with sleep, it leads to difficulty in falling asleep, and the number of awakenings at night increases, which leads to fatigue, depression, and memory loss^[18]. Zou Huili et al.^[19] have confirmed that the symptoms caused by RLS, including attention, memory, higher cognitive function, and poor emotional behavior are related to abnormal sleep. Because the main complaints of RLS patients are insomnia and daytime sleepiness, they have not attracted the attention of clinicians, so the rate of clinical errors and missed diagnosis is high. RLS is divided into two categories: primary and secondary^[16]. Primary RLS generally has no clear cause, but usually has a positive family history. Some studies believe that the disease is autosomal dominant^[18]; secondary RLS is often associated with end-stage renal disease, pregnancy, iron-deficiency anemia, folic acid and vitamin B deficiency, Parkinson's disease, metabolic disease, and drug-induced^[16]. The exact pathogenesis of RLS is still unclear, and some studies suggest that it is related to iron deficiency in the central nervous system, dopaminergic dysfunction of the central nervous system, and gene variation^[20].

(2) Diagnostic criteria: According to the ICSD-3 published by the American Academy of Sleep Medicine^[1] and the diagnostic criteria established by the International Restless Leg Syndrome Research Group in 2014^[21], the diagnosis of RLS must meet the following conditions: There is an urgent need for activity Desires in the legs, usually accompanied or thought to be caused by leg discomfort. Also meet the following symptoms: symptoms appear or worsen with rest or inactivity, such as lying or sitting;

symptoms are partially or completely relieved by exercise, such as walking or stretching the legs, at least with activity; symptoms are all or mainly Occurs in the evening or night, not during the day. The above symptoms cannot be explained by other diseases or behavioral problems (such as leg cramps, postural discomfort, myalgia, varicose veins, lower extremity edema, arthritis, or habitual tiptoe). The above symptoms cause anxiety, distress, sleep disorder, or psychological, physical, social, occupational, educational, behavioral and other important functional impairments. Supportive diagnosis: positive family history, effective dopamine preparations, increased periodic limb movement of sleep (PLMS) index on PSG, lack of significant daytime sleepiness. According to case 2, the symptoms appeared at night rather than during the day, there was a positive family history, the dopamine treatment was effective, and secondary factors were excluded, all of which met the above diagnostic criteria. Diagnosis of primary RLS. The above symptoms of the patient had disappeared after active treatment

(3) Differential diagnosis: Nocturnal leg muscle spasm: unilateral and involuntary muscle pain contractions, or transient muscle spasms. Unlike RLS, nocturnal leg muscle spasms can be effectively relieved (at least temporarily) by simple dorsiflexion or extension of the foot. This patient did not have the above conditions. can't sit quietly: It is often related to the use of antipsychotics, and the desire to exercise is not necessarily related to leg discomfort; there is no nighttime aggravation, and it cannot be relieved or disappeared after activities. This patient did not have the above conditions. Positional leg discomfort:Prolonged sitting may cause localized pain in small areas, and lack of circadian rhythm. The symptoms are relieved after changing the position. None of the patients in this case had any of the above symptoms.

The treatment of RLS includes drug and non-drug treatment. Non-drug treatment includes sleep hygiene education, avoiding or reducing the intake of caffeine, nicotine, and alcohol. Drug treatment includes iron supplementation, dopamine receptor agonists, benzodiazepines, etc. [22]. The patient improved significantly after pramipexole hydrochloride treatment.

2. Aeromedical identification of abnormal sleep behavior

Regarding the charter of sleep disorders for pilots, the U.S. Air Force waiver Guide 2020 [23] tracer system for the evaluation of the past 5 years showed that 534 pilots with sleep disorders applied for charter, of which 448 (about 84%) Licensed. At present, the United States has formulated a relatively complete aviation medical system guarantee and regulations for the research on sleep diseases of pilots, and put forward clear physical standards and charter guidelines. However ,the research on sleep medicine in our army is relatively late. There is no clear identification standard for various sleep disorders in the medical examination standards for flight personnel formulated in 1996. In recent years, after recognizing the impact of sleep diseases on flight safety, our army is gradually improving the corresponding aviation medical identification. At present, there are few reports of abnormal sleep behavior of pilots in China. In 2002, Yu Zhijia et al. [24] reported 2 cases of fighter pilots who were diagnosed with RLS. After active treatment, the symptoms disappeared and they were qualified to fly. However, the study by Düz et al. [25] confirmed that RLS may have nothing to do with flight factors. In this article, the symptoms of 2 pilots

have disappeared after active and standardized treatment, and no other diseases affecting the flight were found. After the relevant personnel fully evaluated his situation, the flight qualification conclusion was given after discussion by the Aviation Medical Appraisal Committee of the Air Force Special Medical Center. We suggest that aviation health security departments at all levels should strengthen their awareness of sleep disorders. We should strengthen sleep hygiene education and popularize sleep knowledge for flight personnel, and implement individualized diagnosis, treatment and identification according to the latest general medicine and aviation medicine guidelines.

Declarations

Ethics Statement:

This study was approved by the Ethics Committee of the Air Force Medical Center, PLA.

publication statement:

All authors agree to be published in this journal.

Availability of data:

All data are available in this manuscript.

Conflict of interest:

All authors declare no conflict of interest.

Author contributions:

Hongjin Liu directed this manuscript, Nannan Sun collected the data and wrote this manuscript

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