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Study on Clinical Characteristics of Obstructive Sleep Apnea Classification During Rapid Eye Movement and Non-rapid Eye Movement

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Abstract: A person's brain is sometimes more active when asleep than when awake, but sleep also slows down many other physiological processes, from heart rate and breathing to body temperature and blood pressure. In this paper, the clinical characteristics of obstructive sleep apnea were studied by analyzing sleep activity in different stages of rapaid eye monement (REM) and Non rapid eye movement movement (non-REM) patients.

Keywords: Rapid eye movement; Non-rapid eye movement; Obstructive sleep apnea

1. Obstructive Sleep Apnea

Obstructive sleep apnea (OSA), which can damage many systems in the body, is a disease that truly affects the whole body. Complications include: causing or exacerbating hypertension (nocturnal and morning hypertension); coronary heart disease, nocturnal angina pectoris and myocardial infarction; serious arrhythmias and tachycardia occur at night; cerebral thrombosis and cerebral hemorrhage; seizures; Alzheimer's disease. mental disorders: anxiety disorders, depression, language disorders, strange behavior, personality changes, hallucinations. Typical clinical symptoms are possible neuropsychiatric symptoms, including inattention, memory loss, irritability, anxiety or depression. During REM, people can see vivid dreams. Although REM sleep behavior disorder (RBD) is a rare disease, it not only brings danger to patients, but also causes many nervous system diseases.

The prevalence of OSA in male and female was about 2:1, but it was significantly increased in postmenopausal women. Obesity is an important cause of OSA, and OSA can aggravate obesity. Family history of OSA may be manifested in maxillofacial structure, obesity, respiratory sensitivity and other aspects. Both sedatives and hypnotics can reduce the sensitivity of the respiratory center to hypoxia and high CO2, reduce the tension of the dilator muscles of the upper respiratory tract, and make the upper respiratory tract more prone to collapse and produce apnea [1]. Patients often seek treatment for sleep injuries or nightmares. In the elderly, the incidence of RBD is as high as 2%, and RBD which occurs secondary to other neurodegenerative diseases is very common. RBD can be diagnosed by simple screening for problems, while similar diseases can be excluded and diagnosed by polysomnography.

2. Obstructive Sleep Apnea with Other Sleep Disorders

2.1. OSA with insomnia

In clinical practice, 39% to 68% of patients with OSA symptoms also suffer from insomnia, and about half of these patients are diagnosed with OSA after PSG monitoring. Insomnia is the main clinical manifestation of OSA patients. Compared with OSA alone, OSA patients with insomnia were younger, more female, had less sleep awareness (compared with OSA patients who were normal), had more sleep disturbances and sleep-related daytime dysfunction, had a poorer quality of life, and had more psychiatric co morbidities, cardiovascular disease, and pulmonary disease. Patients with OSA combined insomnia used more hypnotic drugs than patients with OSA alone. The main type of insomnia is that it is difficult to maintain sleep, while the proportion of simple difficulty in falling asleep is very small. If insomnia is secondary to OSA, CPAP ventilator can relieve insomnia. If insomnia exists independently, CPAP ventilator therapy is not effective in improving sleep, while insomnia treatment may be effective, including cognitive behavioral therapy and drug therapy.

2.2. OSA with paroxysmal sleep disorders

Abnormal sleep behavior and RBD are the core characteristics of nightmares. Studies have shown that patients often show restlessness during sleep, such as dreaminess and frequent physical activities. REM sleep structure is

regulated by reticular nucleus, locus coeruleus nucleus and amygdala. The damage of these areas can lead to RBD. Patients can also talk, scream and groan during sleep, but only about half of the patients know that they have these abnormal behaviors during sleep.

2.3. OSA behavior disorder with REM (RBD)

Sleep apnea syndrome is divided into central, obstructive and mixed. OSA is the absence of airflow from the nose and mouth and the presence of breathing in the chest and abdomen. Central sleep apnea (CSA) is the simultaneous disappearance of both oral and nasal airflow and thoracic and abdominal breathing. Mixed sleep apnea (MSA) is defined as a period of apnea during which both oral and nasal airflow and thoracic and abdominal breathing are eliminated. After a few seconds or tens of seconds, the chest and abdomen breathing movement occurs, and there is still no oronasal airflow [2]. In severe cases, psychological, intellectual and behavioral abnormalities may occur; high blood pressure, coronary heart disease, arrhythmia may occur. More than two-thirds of people diagnosed with idiopathic RBD develop dementia or Parkinson's disease later in life. OSA was found in 34% to 61% of RBD patients. In addition, increasing weight gain was observed.

3. Characteristics of Obstructive Sleep Apnea during REM and Non-REM Periods

A person's sleep affects brain and body activity, and sleep researchers already know that there are two types of sleep: rapid eye movement (REM) sleep and non-rapid eye movement (non-REM) sleep. During sleep, the brain repeatedly goes through four different REM and non-REM sleep stages in a specific order, changing between the upper and lower parts of sleep. As sleep occurs in four to five consecutive sleep cycles, more time is spent in the REM phase.

3.1. Non-REM sleep period

Phase N1 is when a person is drowsy, he or she enters the N1 state of sleep. During the first phase of non-REM sleep, a person is transitioning from being awake to falling asleep. This is a relatively light form of sleep that lasts about five to ten minutes. During this stage, heart rate and breathing begin to slow down, eye movements slow down, muscles relax, and body temperature drops. If brain waves are observed on an EEG in a sleep lab, they slow down, a person wakes easily from N1 sleep, and it may think he or she is not asleep. N1 sleep is the first stage of a nap. It is normal for a person to experience a twitch during N1 sleep, which is a sudden transient muscle twitch. When this happens, the sudden movement may be awakened from sleep. Adults spend the least time on N1 sleep, accounting for about 5% of their total sleep time.

Stage N2 is the second stage of non-REM sleep, usually lasting 10 to 25 minutes, shortly after the end of N1 sleep, also known as the sleep phase. During this stage, eye movement stops, heart rate slows, brain waves slow down, and muscles relax further. According to the National Institutes of Health in the USA, as sleep cycles were repeated, people slept longer in N2 than in any other stage of sleep, accounting for 55% of adults' total sleep time.

Non-REM sleep enters the third stage, often referred to as "slow wave", "incremental" or deep sleep. N3 sleep is a kind of deep sleep, and a person usually spends more time in the N3 stage of the upper half of sleep than in the lower half of sleep, but it is not clear why this happens. N3 sleep usually lasts for 20 to 40 minutes, which weakens the brain's response to external stimuli, so waking up from this stage is the most difficult. People who wake up from N3 sleep are very sleepy and disoriented, and this drowsiness is one of the reasons why people may not want to sleep for more than 30 minutes, because they will enter N3 sleep, heart rate and breathing will fall to the lowest level during N3 sleep, body temperature will drop more slowly, no eye movement, blood pressure drops, but not to dangerous levels [3]. This is also the most likely stage of sleepwalking and sleep conversation. Nightmares and night terrors are also N3 sleep phenomena, and night terrors usually occur in children at N3 stage.

3.2. REM sleep period

A person enters REM sleep about 90 minutes after falling asleep and goes through all three stages of non-REM sleep. REM sleep is characterized by rapid eye movement from side to side, under the closed eyelids. Although this kind of eye movement doesn't happen very often, scientists don't know exactly why. REM sleep is the stage of most dreams in which vivid images occur, although some speculate that this is related to dreams. People usually have less memory of dreams, but if they wake up from REM sleep, they are more likely to recall aspects of the dream, including an increase in heart rate and a slight increase in blood pressure compared to N1 sleep. During sleep, when body temperature drops to its lowest point, the muscles of the arms and legs relax so deeply that they can barely move, which may prevent people from having their own dreams. Breathing becomes faster and lighter, and sleep experts say the brain may be more active during this stage of sleep than during wakefulness, as it processes information from the beginning of the day to store it in long-term memory.

Newborn babies may spend about 80% of their total sleep time in REM sleep. According to the National Institutes of Health in the USA, infants spend at least 50% of their sleep time in REM sleep. In contrast, most adults spend 20% to 25% of their total sleep time in REM sleep. The proportion of time spent in this state of sleep remains

relatively constant throughout adulthood, but may decrease in the over-65 age group. Older adults tend to sleep less and experience more brief wakefulness, but these short awakenings do not affect energy levels.

4. Clinical Features and Diagnosis of Obstructive Sleep Apnea

Studies show that 34-47% of PD patients have symptoms of REM sleep behavior disorder (RBD). In addition, abstinence may be accompanied by RBD. The core characteristics of RBD are abnormal sleep behavior and nightmares. The most common behaviors included punching, kicking and falling out of bed, with 21% suffering partner injuries, according to the study. In addition, patients can talk, scream, and croon during sleep, but only about half of patients are aware of these abnormal behaviors during sleep. It has been reported that some RBD patients may suffer life-threatening injuries during sleep.

4.1. Polysomnogram (PSG) sleep monitoring

Polysomnography is the standard for diagnosing RBD, and EMG is needed to confirm jaw or limb muscle activity during REM. If the patient is very ill or cannot be PSG overnight, OSA can be diagnosed by night monitoring of PSG results. When the first PSG is negative and OSA is still suspected, the PSG is added to the second PSG.

4.2. Airway assessment

Routine physical examinations include: height, weight and body mass index (BMI), blood pressure, and heart rate calculations. For obese patients, it is recommended to measure chest, abdominal, hip, and elbow circumference in addition to neck circumference. Cephalometric analysis is helpful to assess whether the bone structure of the maxillofacial region is abnormal. For patients undergoing OSA surgery and suspected of occupying space in the upper respiratory tract, it is recommended to improve the upper respiratory tract by 3D CT scan before treatment.

4.3. Assessment of sleepiness

The multiple sleep latency test (MSLT) is an objective indicator of daytime sleepiness, but is not a routine method for assessing and diagnosing OSA. If patients receiving the best treatment are still lethargic during the day, it can be used to determine whether they have other sleep disorders [4]. The work of medical personnel in primary medical institutions is not restricted by professional departments. Patients who receive daily treatment may suffer from a variety of conditions, including OSA. It is critical that medical personnel be fully aware of the disease and remain sufficiently alert. It is recommended to consider the disease in clinical work under the following conditions: high obesity, short neck, micrognathia and mandibular retraction, pharyngeal stenosis or tonsillar hypertrophy, enlarged tongue or refractory nasal congestion, recurrent moderate and severe snoring and apnea, dry mouth in the morning, daytime drowsiness and unexplained fatigue, nocturnal angina, arrhythmia, etc.

4.4. Diagnosis during REM sleep

In terms of differential diagnosis, healthy individuals, especially young people, may also have sleep disorder behaviors under the premise of excessive fatigue or drinking, which may also be normal in postpartum women. In addition to sleepwalking and night action, polysomnograms need to rule out a number of important similar conditions, including obstructive sleep apnea, nighttime frontal epilepsy, and periodic leg movements during sleep.

5. Conclusion

For obstructive sleep apnea, any harmful drugs that may aggravate RBD should be removed as safely as possible, and clinicians should investigate other potential secondary causes of RBD based on the patient's history and examination. Non-drug therapy, especially changing the sleep environment, is an important measure to reduce the risk of injury for RBD patients and their partners. Clinicians should pay attention to the adjustment of sleep environment and consider it as the standard treatment for non-drug therapy.

For future disease risk, in the absence of effective neuroprotective measures, the focuses of RBD screening, disease risk information disclosure and follow-up assessment are still under discussion. It is important to remember that although patients have an increased risk of developing neurodegenerative diseases, this is not absolute, because current risk assessment data come from the population of patients selected in the study. Or include patients in clinical studies to explore more neuroprotective measures.

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