Sleep in Neuromuscular Diseases

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KEYWORDS

• Neuromuscular disease • Neuromuscular junction disorder • Motor neuron disease
• Amyotrophic lateral sclerosis • Myasthenia gravis • Spinal cord disorders • Phrenic nerve damage
• Myotonic dystrophy

KEY POINTS

- Patients with neuromuscular diseases should be routinely evaluated for symptoms of sleep dysfunction and sleep disordered breathing because these are treatable complications in an otherwise progressive disease process.
- Inspiratory vital capacity of less than 60% is a predictor of sleep disordered breathing in children and adolescents with neuromuscular disorders.
- The gold standard diagnostic test for patients with hypersomnia and nocturnal sleep disturbances is overnight polysomnogram, in some cases followed by a multiple sleep latency test.
- Sleep abnormalities of central origin are seen in myotonic dystrophy, which may not depend on the muscular deficit.
- Noninvasive ventilation has been shown to improve quality of life and mortality in patients with amyotrophic lateral sclerosis and other neuromuscular disorders.

INTRODUCTION

Sleep disorders are commonly seen in patients affected with neuromuscular diseases. However, the presence of sleep dysfunction is often overlooked because symptoms related to sleep disturbance are frequently attributed to the patient's underlying neurologic illness. It was not until the 1950s that clinicians became aware of sleep disorders and sleep-related respiratory compromise in patients with neuromuscular disease. Investigators crucial to highlighting sleep disorders in this patient population include Sarnoff and colleagues[1] who, in 1951 discussed hypoventilation in patients with poliomyelitis, and Benaim and Worster-Drought[2] who, in 1954, described alveolar hypoventilation in myotonic dystrophy.

Since the advent of clinical polysomnography, sleep disordered breathing and other sleep alterations, such as periodic limb movements of sleep (PLMS), have been uncovered in patients with neuromuscular and spinal cord disorders. In addition, widespread use of polysomnography has been able to quantify and show the beneficial effects of noninvasive positive breathing applications in this patient population.

In general, sleep disturbances in neuromuscular diseases are often caused by sleep-related ventilatory dysfunction; in some cases central hypersomnia, as in myotonic dystrophy, has also been observed. Damage to the anterior horn cell, motor root, peripheral nerve, neuromuscular junction, or the muscle fiber can result in thoracic, diaphragmatic, or oropharyngeal muscle weakness resulting in sleep dysfunction.

In addition to sleep-related respiratory compromise, patients with painful polyneuropathies and muscle pain in the setting of immobility often

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experience insomnia, sleep fragmentation, excessive daytime sleepiness, and symptoms of restless legs syndrome (RLS). Insufficient sleep can result in morning headaches, irritability, anxiety, depression, and impaired cognition.

It is important to identify symptoms of sleep dysfunction because treatment can be effective and improve quality of life. Early identification and treatment with noninvasive ventilation has been shown to improve not only quality of life but also survival in patients with amyotrophic lateral sclerosis (ALS).[3–5]

This article reviews the sleep disturbances found in spinal cord diseases (including poliomyelitis, ALS, and spinal cord injury), myopathies (including hereditary and inflammatory myopathies), neuropathies (including acute inflammatory demyelinating polyneuropathy), and neuromuscular junction disorders.

DIAGNOSTIC WORK-UP

A detailed sleep history is an essential component to the initial evaluation of patients with a suspected sleep disorder. It is advisable to perform the history in the presence of a family member such as a spouse or caregiver. These individuals can offer vital information because they often have a different insight into the patient's behavior during sleep or daytime functioning. For instance, many patients with PLMS are unaware of any nocturnal movements. However, their bed partners are typically affected by these symptoms and can provide details regarding nocturnal manifestations that may be unknown to the patient.

At times patients may not be aware that their daytime symptoms, such as morning headaches, fatigue, or cognitive impairment, may be related to a sleep disorder, and they often attribute these symptoms to their underlying neurologic illness. It is imperative that clinicians maintain a high index of suspicion for potential sleep disorders. Patients with neuromuscular diseases, particularly those with respiratory dysfunction, should specifically be screened for symptoms suggestive of sleep disordered breathing, such as snoring, witnessed apneas, or excessive daytime sleepiness. Episodes of nocturnal orthopnea should be investigated because this may be a sign of early respiratory muscle weakness and hypoventilation. Screening tools currently available include the Epworth Sleepiness Scale, STOP-BANG, and Pittsburgh Sleep Quality Index Scale. Concurrent medical issues, medication, and alcohol use should also be identified.

Nocturnal polysomnography is the test of choice to identify and quantify sleep disordered breathing. In addition, the overnight study can uncover other sleep alterations commonly found in patients with neuromuscular disease, such as sleep onset insomnia, reduced sleep efficiency, and PLMS. All patients with positive screening for sleep disordered breathing, those with respiratory dysfunction, patients with bulbar weakness, and those with excessive daytime somnolence should undergo a diagnostic overnight polysomnogram.

A multiple sleep latency test (MSLT) should be performed in order to document the presence and severity of daytime sleepiness and to diagnose associated narcolepsy. In selected patients with respiratory weakness, electromyogram (EMG) and nerve conduction studies can be used to assess for phrenic and intercostal neuropathy.

Other tests, including pulmonary function tests to assess lung volume, gas exchange, and arterial blood gases, can be used to evaluate the integrity of the respiratory control system. Patients with symptoms of RLS should have iron studies performed and should be supplemented with iron if necessary.

SPECIFIC NEUROMUSCULAR CONDITIONS WITH SLEEP DISORDERS

Sleep Disorders in Motor Neuron Disease

ALS is the most common motor neuron disease. It is a neurodegenerative disorder characterized by progressive loss of motor neurons in the brain and spinal cord, resulting in the hallmark combination of upper and lower motor neuron signs and symptoms. Patients develop muscle weakness and paralysis, and eventually die of their disease. The median survival from the time of diagnosis is 3 to 5 years. Roughly 10% of patients survive 10 years or more. Presently the disease is incurable and management provides symptomatic treatment.

The most common cause of death in ALS is progressive neuromuscular respiratory failure. The loss of motor neurons in the brainstem and spinal cord results in pharyngeal, laryngeal, diaphragmatic, and intercostal muscle weakness that predisposes patients with ALS to respiratory dysfunction.[6] When respiratory compromise becomes severe, patients require tracheostomy and permanent ventilation. The deterioration of pulmonary function is highly predictive of mortality.[7,8]

Several studies have shown that breathing abnormalities during sleep often precede daytime respiratory dysfunction.[6,7,9] Patients with ALS develop sleep-related ventilatory abnormalities caused by the combination of central neurogenic dysfunction and peripheral muscle atrophy (**Box 1**).