

Sleep and Neurology: Critical Bidirectional Impact

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Introduction

This review highlights frequent sleep disturbances and abnormal EEG patterns in individuals with neurodevelopmental disorders like autism and ADHD. Understanding these co-occurring issues is crucial for effective management, as addressing sleep problems significantly improves quality of life and cognitive outcomes. The article emphasizes the complex interplay between brain development, sleep regulation, and neurological functioning [1].

This article delves into the intricate disruption of the sleep-wake cycle in Parkinson's disease, offering new perspectives beyond traditional motor symptoms. It discusses how altered circadian rhythms, REM sleep behavior disorder, and excessive daytime sleepiness contribute to the disease's burden. These insights could pave the way for novel therapeutic strategies targeting non-motor symptoms and improving patient well-being [2].

This review explores the prevalence and mechanisms behind various sleep disorders in multiple sclerosis, ranging from insomnia to restless legs syndrome and sleep-disordered breathing. It connects MS-related inflammation, demyelination, fatigue, and sleep disturbances, offering a comprehensive look at current therapeutic interventions and highlighting future research areas to enhance patient care [3].

This narrative review emphasizes the bidirectional relationship between sleep and epilepsy, illustrating how sleep deprivation triggers seizures and how epilepsy disrupts sleep architecture. It covers the spectrum of sleep disturbances in epileptic patients, discussing their impact on seizure control, quality of life, and treatment, advocating for integrated approaches to manage both conditions effectively [4].

This overview sheds light on the strong association between sleep disorders and migraine, noting how insomnia, sleep apnea, and restless legs

syndrome are prevalent among migraine sufferers. It explores complex pathophysiological links, suggesting that managing sleep disturbances is not merely supportive care but a potential avenue for improving migraine frequency and intensity, stressing a holistic treatment approach [5].

This comprehensive review explores fundamental connections between a wide range of neurological disorders and sleep disturbances. It highlights how conditions like Parkinson's, Alzheimer's, and even stroke profoundly impact sleep architecture, and conversely, how disrupted sleep exacerbates neurological symptoms. The article underscores the critical need for clinicians to assess and manage sleep effectively in patients with neurological conditions [6].

This systematic review meticulously examines the prevalence and characteristics of sleep disorders in individuals with Amyotrophic Lateral Sclerosis (ALS). It discusses how respiratory dysfunction, muscle weakness, pain, and psychological factors contribute to poor sleep quality in ALS patients, emphasizing the significant impact on daily functioning and quality of life. The review advocates for better recognition and management of these often-underestimated issues [7].

This article explores the intricate relationship between sleep disturbances and Alzheimer's disease, highlighting how sleep-wake cycle alterations are both early markers and potential drivers of neurodegeneration. It reviews common sleep problems like insomnia, REM sleep behavior disorder, and excessive daytime sleepiness in AD, pointing out knowledge gaps and crucial future research directions for therapeutic interventions [8].

This review underscores the profound and bidirectional influence between sleep and epilepsy. It details how sleep deprivation can lower seizure threshold and how epileptic activity disrupts normal sleep architecture, exacerbating symptoms and impacting quality of life. The authors emphasize the necessity of considering sleep as a critical factor in the diagnosis and management of epilepsy, advocating for integrated care approaches [9].

This narrative review explores common and complex sleep disturbances across various movement disorders, including Parkinson's disease, restless legs syndrome, and Huntington's disease. It highlights how these sleep issues often precede or accompany motor symptoms, significantly impacting patient quality of life. The article discusses underlying neurobiological mechanisms and calls for improved diagnostic and therapeutic strategies tailored to these specific patient populations [10].

Description

Sleep disturbances represent a significant and frequently overlooked comorbidity across a broad spectrum of neurological disorders. Research consistently demonstrates a profound, often bidirectional, relationship where underlying neurological pathologies directly influence sleep architecture, and conversely, poor sleep quality can exacerbate disease symptoms and

progression [6]. For instance, individuals with neurodevelopmental disorders like autism and Attention Deficit Hyperactivity Disorder (ADHD) frequently experience sleep disturbances alongside abnormal electroencephalogram (EEG) patterns. Recognizing and addressing these sleep issues is vital, as effective management can lead to substantial improvements in quality of life and potentially better cognitive outcomes, highlighting the complex interplay between brain development, sleep regulation, and neurological function [1].

Specific neurodegenerative conditions reveal distinct patterns of sleep disruption. Parkinson's Disease (PD) is characterized by an intricate disruption of the sleep-wake cycle, extending beyond its traditional motor symptoms. Altered circadian rhythms, REM sleep behavior disorder (RBD), and excessive daytime sleepiness are common, contributing significantly to the overall burden of the disease. Understanding these non-motor symptoms opens avenues for novel therapeutic strategies aimed at improving patient well-being [2]. Similarly, Alzheimer's Disease (AD) is strongly linked to sleep-wake cycle alterations, which are not just symptoms but potentially early markers and drivers of neurodegeneration. Common sleep problems in AD, such as insomnia, RBD, and excessive daytime sleepiness, demand further research to inform future therapeutic interventions [8]. Beyond these, a narrative review explores complex sleep disturbances observed across various movement disorders, including PD, restless legs syndrome, and Huntington's disease, noting that these issues often precede or accompany motor symptoms and severely impact patient quality of life, underscoring the need for tailored diagnostic and therapeutic strategies [10].

Other neurological conditions also exhibit unique sleep challenges. Multiple Sclerosis (MS) patients commonly experience various sleep disorders, including insomnia, restless legs syndrome, and sleep-disordered breathing. The pathogenesis often involves MS-related inflammation, demyelination, and fatigue, all contributing to sleep disturbances. A comprehensive understanding of these links is essential for current therapeutic approaches and guiding future research to enhance patient care [3]. In Amyotrophic Lateral Sclerosis (ALS), a systematic review highlights the prevalence and characteristics of sleep disorders, where respiratory dysfunction, muscle weakness, pain, and psychological factors collectively impair sleep quality. This significantly impacts daily functioning and quality of life for ALS patients, emphasizing the need for better recognition and management of these often-underestimated problems [7]. Migraine sufferers frequently present with sleep disorders like insomnia, sleep apnea, and restless legs syndrome. The complex pathophysiological links suggest that managing sleep disturbances could be a key strategy not just for supportive care, but directly for improving migraine frequency and intensity, advocating for a holistic treatment approach [5].

Epilepsy presents a particularly compelling bidirectional relationship with sleep. Sleep deprivation is known to lower the seizure threshold, while epileptic activity itself severely disrupts normal sleep architecture, creating a vicious cycle that exacerbates symptoms and diminishes quality of life [4]. Another review reinforces this profound and bidirectional influence, detailing how sleep deprivation can trigger seizures and how epileptic activity directly interferes with sleep patterns. The authors stress the critical necessity of integrating sleep assessment into the diagnosis and management of epilepsy, advocating for comprehensive, integrated care approaches that consider sleep as a fundamental factor [9].

Collectively, these findings underscore the pervasive nature of sleep distur-

bances across diverse neurological conditions, from neurodevelopmental and neurodegenerative disorders to inflammatory, movement, and seizure disorders. The consistent message across research is the critical importance for clinicians to assess and manage sleep effectively in patients with neurological conditions. Understanding the intricate underlying mechanisms and their impact on patient outcomes is paramount for developing comprehensive, integrated therapeutic strategies that significantly improve patient well-being and quality of life.

Conclusion

Sleep disturbances are a widespread and critical comorbidity across a diverse range of neurological disorders, profoundly impacting patient quality of life and disease progression. Research consistently demonstrates a bidirectional relationship: neurological conditions frequently disrupt sleep architecture, and conversely, poor sleep exacerbates neurological symptoms. For instance, neurodevelopmental disorders like autism and ADHD are often accompanied by sleep disturbances and abnormal EEG patterns, where addressing sleep issues can improve cognitive outcomes [1]. Similarly, neurodegenerative conditions such as Parkinson's Disease and Alzheimer's Disease exhibit intricate sleep-wake cycle disruptions, including altered circadian rhythms, REM sleep behavior disorder, and excessive daytime sleepiness, which are recognized as both symptoms and potential drivers of neurodegeneration [2, 8].

Movement disorders, including restless legs syndrome and Huntington's disease, also present complex sleep challenges, often preceding or accompanying motor symptoms [10]. Other conditions like Multiple Sclerosis manifest various sleep disorders linked to inflammation and fatigue [3], while Amyotrophic Lateral Sclerosis patients struggle with sleep quality due to respiratory issues, muscle weakness, and pain [7]. Migraine sufferers frequently experience insomnia, sleep apnea, and restless legs syndrome, suggesting that managing sleep can directly impact migraine frequency [5]. Epilepsy highlights a clear bidirectional link, as sleep deprivation lowers seizure thresholds and epileptic activity disrupts sleep, emphasizing the need for integrated care [4, 9]. These findings collectively highlight the urgent need for clinicians to proactively assess and manage sleep in neurological patients to enhance overall well-being.

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