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Evaluating the Impacts of Parasomnias on Sleep and Exploring Their Therapeutic Interventions

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ABSTRACT

Sleep disorders are topics of important discussion as they apply to a function crucial for the growth and development of individuals. Sleep plays a pivotal role in one's long-term health but various disorders may limit or prevent high-quality sleep for children and adults. One of these common disorder groups is parasomnias. As there is still much to learn in medicine when it comes to parasomnias and their treatments, it is of utmost importance to understand the processes behind the occurrence of parasomnias and their associated conditions. This review breaks down the most common parasomnias, categorizing them based on the onset of disease during rapid eye movement (REM) or non-rapid eye movement (NREM) sleep stages. This includes somnambulism (sleepwalking), confusional arousals, night terrors, REM behavior disorder (RBD), nightmare disorder, and others. It highlights the characteristics of diagnosis for these individual disorders and attempts to evaluate them through an etiological, epidemiological, and pathophysiological lens. This review also presents the current pharmacological and non-pharmacological interventions for these disorders.

Introduction and Background

Sleep disorders are a very significant topic due to sleep being a universal and crucial function for all living species. These disorders are very common and can be caused by a variety of dysfunctions and irregularities in the body, resulting in severe consequences on individuals' health (K. Pavlova & Latreille, 2019). These main disorders include insomnia, parasomnias, restless legs syndrome, circadian rhythm disorders, etc. Due to the differences presented by these disorders, the overall evaluation process varies based on the patient/individual. As there are no initial fixed treatments, it would take time and effort to properly diagnose and determine the best treatment for the patients.

However, after taking time to analyze the most impactful and common disorders that limit proper sleep, I found that parasomnias should be the focus. Parasomnias are sleep disorders that involve unusual behaviors during sleep which are prominently during the arousal period between sleep and wakefulness. Studies have proven through research that parasomnias occur when the brain transitions in and out of sleep, between the rapid eye movement (REM) and non-rapid eye movement (NREM) sleep stages. In this review, various key parasomnias including somnambulism (sleepwalking), night terrors, confusional arousal, and REM behavior disorder (RBD) are thoroughly explained to allow others to expand their knowledge on a topic that I was able to learn so much about throughout the course of my research. Despite other disorders such as sleep apnea and insomnia being quite typical, parasomnias focus more on the physical aspect of what your body is capable of during sleep. It is vital that treatment planning is prioritized to further understand these unusual and abnormal behaviors seen during sleep. This review not only discusses the common types of parasomnias but also provides an understanding of the general REM and NREM sleep stages to properly classify each disorder. For instance, confusional arousal, somnambulism, and sleep terrors are all parasomnias that occur during non-rapid eye movement sleep (NREM). On the contrary, parasomnias such as REM-sleep behavior disorder (RBD) and nightmare disorder occur during rapid eye movement sleep (REM) (Markov et al., 2006) (Attarian, 2010). It also presents an abundance of information on the risk factors and triggers for these parasomnias, the pathophysiological and epidemiological processes involved, and their proper methods of non-pharmacological and pharmacological treatments.

Sleep Stages

Sleep consists of two different stages of sleep where all the activity occurs during the night. The first stage of sleep is known as NREM sleep or non-rapid eye movement sleep which occurs in four different stages. Sleep begins during Stage 1 of NREM sleep which is known as the "shallow" stage (Markov et al., 2006). It is the lightest stage of sleep and can be seen as the stage closest to wakefulness (state of consciousness). Throughout the night, sleep eventually deepens to the later stages which include NREM Stages 2, 3, and 4. Stages 3 and 4 of NREM sleep are known as slow-wave sleep due to them occurring when deep sleep is the strongest, which is during the first third of the night. (Markov et al., 2006) During slow-wave sleep is when most NREM parasomnias occur such as confusional arousals, sleepwalking, and night terrors (Zergham & Chauhan, 2023). These disorders occur during a state where sleep and wakefulness coexist meaning that the sleeper is either partially asleep or partially awake (Ohayon et al., 1999; Winkelman et al., 1999).

Following the NREM sleep period is a 90-minute REM episode. REM sleep episodes grow longer as the night progresses and are the longest during the last third of the night (Kryger et al., 2010). During these periods, individuals experience more complex and deep disorders as the body orchestrates intricate interactions between multiple neuronal networks. Due to the body being in a state of deep sleep, there is an active inhibition of skeletal muscle activity during REM sleep. This means that there is very little body movement as the brain is most active during this time, making it difficult for sleepers to act out or move due to their dreams. Some notable REM sleep parasomnias include REM-sleep behavior disorder (RBD) and nightmare disorder (Academy of Sleep Medicine, 2005; Markov et al., 2006; Ohayon et al., 1997).

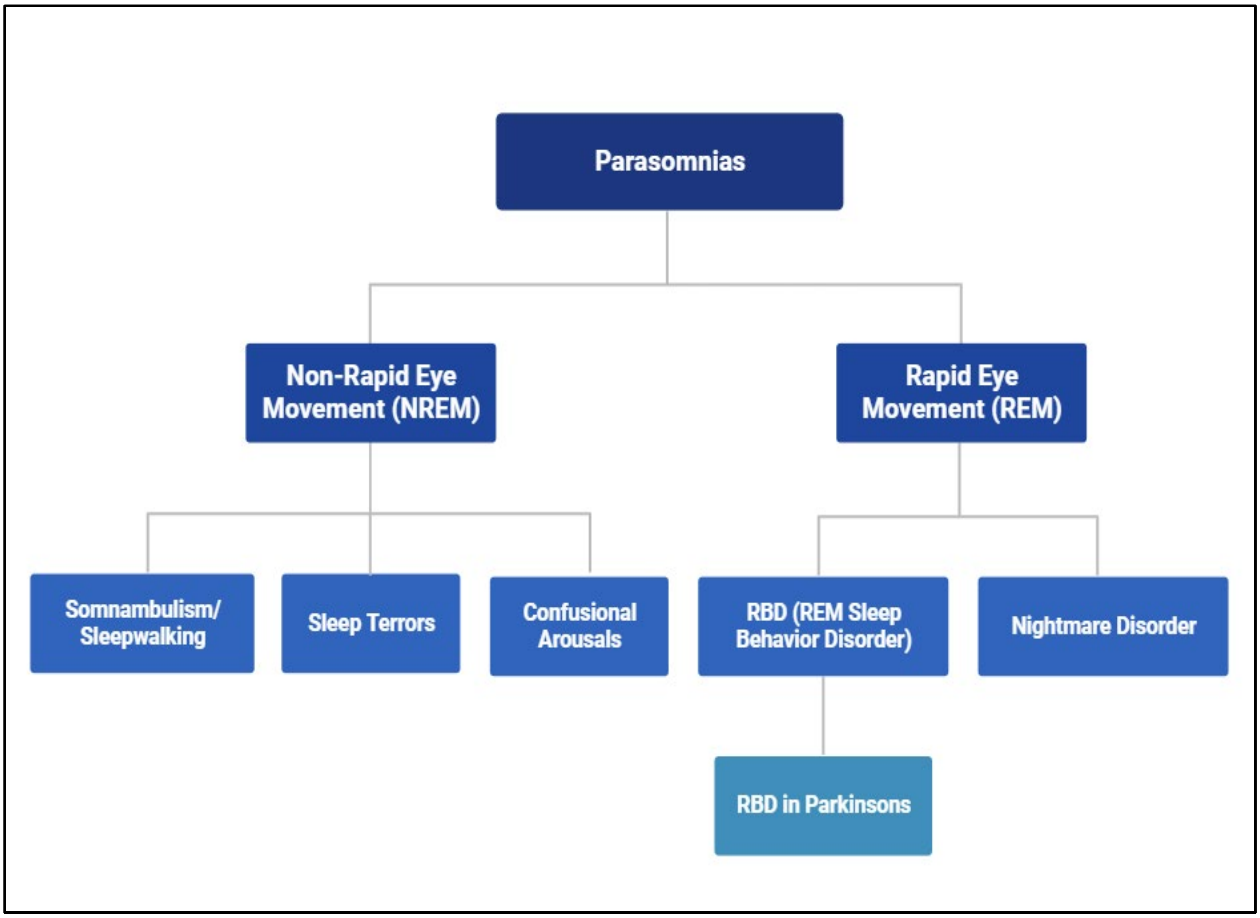

Figure 1. Flow Chart Showing NREM and REM Parasomnia Classification

Sleep Apnea Relation to Parasomnias

Sleep apnea is the absence of inspiratory airflow and can either be classified as obstructive or central. It results from an absence of brainstem neutral output to the upper airway muscles and lower thoracic inspiratory pump muscles (Javaheri et al., 2017). Sleep-disordered breathing (SDB), seen as both obstructive sleep apnea (OSA) and central sleep apnea (CSA), is common for many illnesses and disorders. For instance, sleep apnea is a common risk factor for many cardiovascular diseases with SDB being a major worldwide concern (Fudim et al., 2022).

When taking parasomnias into account, sleep apnea is a common trigger. Sleep apnea with various other factors impairs sleep consolidation and increases sleep fragmentation. Individuals who experience somnambulism (sleepwalking) or sleep paralysis also commonly suffer from sleep apnea (Bharadwaj & Kumar, 2007; Bollu et al., 2018). Additionally, sleep fragmentation due to sleep apnea is correlated with sleep enuresis (SE) or the recurrent involuntary passing of urine without intention during sleep. Studies have shown that successful treatment for sleep apnea has resulted in the reduction or even elimination of SE, which accounts for a cure rate of about 15% per year (Bollu et al., 2018).

Parasomnia Diagnosis, Pathophysiology, Epidemiology, and Treatment

NREM Parasomnias

Somnambulism/Sleepwalking

Diagnosis: Chronic sleepwalking in children is associated with behavioral problems and struggles with emotional regulation. When first diagnosing somnambulism in children, it is important to determine if they have had a history of other sleep disorders as it can be crucial in determining the best method of treatment for them (Bharadwaj & Kumar, 2007). An effective and infallible procedure to diagnose somnambulism is the use of polysomnography. Polysomnography (PSG) is an essential tool for the diagnosis of a variety of sleep disorders. It uses various methods to record neurophysiologic, cardiopulmonary, and other physiologic parameters over several hours or sometimes overnight (Jafari & Mohsenin, 2010). From the PSG, medical professionals would have knowledge of the physiologic changes occurring in the body concerning the NREM sleep stages and the state of wakefulness. However, a PSG is not recommended for an initial assessment due to its high cost and inconvenience (Zergham & Chauhan, 2023). This is why most sleepwalking cases are evaluated based on the patient's history of the disorder and reports from close contacts as it is almost just as effective for diagnosis. Nevertheless, a complete review of the patient's medications, thyroid function tests, and screening for neurodegenerative diseases such as Parkinson's should be performed as it may be beneficial to better evaluate the patient. For instance, neurogenerative changes associated with Parkinson's disease (PD) at the brainstem level can impact the "ascending" control of state transition and "descending" control of locomotion and muscle tone, paving the way for sleep disorders such as sleepwalking, REM sleep behavior disorder, and overlap parasomnia (Zergham & Chauhan, 2023) (Poryazova et al., 2007).

Pathophysiology: Studies indicate that there is a decreased localized cerebral blood flow to the frontal and parietal areas for patients who sleepwalk compared to those who do not. There is also a restricted perfusion in the dorsolateral prefrontal cortex where signs of a somnambulistic episode are related to insulin that is found. Patients who sleepwalk and the functional problems they may face during the day may contribute to the changes in cerebral blood flow patterns during resting-state wakefulness (Desjardins et al., 2018; Zergham & Chauhan, 2023). To be able to understand the mechanisms of sleepwalking pathophysiology, the use of an (electroencephalogram) EEG can be crucial to monitoring sleep activity. Based on another set of studies using EEG functional connectivity monitoring, the presence of delta activity before episode onset might suggest that the onset of somnambulism is preceded by a gradual and complex arousal process that occurs in the posterior regions of the brain (Desjardins et al., 2017; Tagliazucchi et al., 2013).

Epidemiology: As somnambulism is a common arousal disorder, it impacts a wide range of individuals. However, when comparing children and adults, sleepwalking has been known to be more common in children. Fewer people experience somnambulism as adults. On the occasions when somnambulism occurs in adults, the disorder is usually a result of medication side effects or neurodegenerative diseases. According to studies conducted by Stallman and Kohler (Stallman & Kohler, 2016) where children, teens, and adults starting from the age of 2 from over 20 different countries were surveyed, it was found that somnambulism was quite frequent in children. The overall study determined that the lifetime prevalence of sleepwalking during childhood was 5.0% compared to 1.5% during adulthood. Another study by Bargiotas and his team (Bargiotas et al., 2017) presented that out of 63 sleepwalkers, 45% had more than one episode per month, 54% had partial recollection of the episodes, and 36% reported trigger factors for sleepwalking. Almost all the participants in the study reported co-occurring parasomnias including confusional arousals (17%) and increased sleep apnea (21%). To further emphasize the significance of somnambulism in children, the cohort showed that 73% of participants reported childhood-onset (CO-SW) adult sleepwalking and 27% reported adult-onset (AO-SW) adult sleepwalking (Bargiotas et al., 2017; Desjardins et al., 2018; Stallman & Kohler, 2016).

<u>Treatment and Management:</u> When it comes to treatment and management, the most effective methods would be the ones that involve pharmacological and behavioral measures, but it is always important to make sure that safety precautions and non-pharmacological treatments are applied first before resorting to medication. Somnambulism is an arousal parasomnia consisting of various complex behaviors such as movements in bed or walking during sleep. For 2-14% of children, somnambulism is benign and very limited, as it is shown to decrease with the onset of puberty. But despite this, at least 25% of children with recurrent sleepwalking may continue to sleepwalk through adulthood (Bharadwaj & Kumar, 2007). During somnambulism/sleepwalking, creating a safe environment for the sleepwalker can be beneficial by keeping them safe and away from harm. This includes locking windows and removing objects that they may bump into (Attarian, 2010). These safety precautions are crucial as they can decrease the risk of injury for the sleepwalker.

Nonpharmacologic treatments for sleepwalking may include scheduled waking, physiotherapy, stress management, and hypnosis (Attarian, 2010). But out of these options, scheduled waking and hypnosis may be the most convenient and effectual as they are safe and have the least adverse effects on the patient and their family. Scheduled waking is where the patients are woken up around 15-30 minutes before when they would normally sleepwalk whereas hypnosis provides the patient with a hypnotic suggestion that the sleepwalker will wake if their feet touch the ground. Both of these interventions should be done daily for about two to three weeks so the patient can avoid the act of sleepwalking (Stallman, 2017). On the contrary, the reason why it is always essential to make sure that non-pharmacological treatments are applied first before resorting to medication is because medication for treatment is not always required in most somnambulism/sleepwalking cases. Additionally, no medication has been approved for the treatment of sleepwalking but based on clinical experience, gamma-aminobutyric acid (GABA) enhancing agents such as clonazepam or gabapentin may be beneficial when taken one hour before sleep (Zergham & Chauhan, 2023). GABA is a neurotransmitter that is responsible for slowing brain activity and regulating your mood, making it easier to sleep.

Sleep Terrors

<u>Diagnosis:</u> Sleep terrors (STs) are parasomnias that are characterized by abrupt arousal from sleep and are associated with autonomic hyperactivity and inappropriate behavior. They are common during childhood between the years of 4 to 12 but can also be present in adulthood (Gigliotti et al., 2022). Sleep/night terrors occur during the first half of the sleep period during slow-wave sleep, including stages 3 and 4 of non-rapid eye movement sleep. They may last 45-90 minutes and can occur for the first three hours of a major sleep episode (Leung et al., 2020). During this time, the individual may feel severe distress, followed by helplessness (Van Horn & Street, 2023) forcing them to awaken abruptly. The child may even scream in fear or immense pain while being in a confused and incoherent state as they would have no recollection of the attack (Leung et al., 2020). Additionally, sleep terrors are typically accompanied by thrashing, kicking, unintelligible speech, and rolling movements in sleep. They would start with increased heart and respiratory rates where the individual may start to sweat (Driver & Shapiro, 1993).

<u>Epidemiology:</u> The prevalence of sleep terrors is greater during childhood compared to adulthood and is reported to peak for children between the ages of 5 to 7 years (Chokroverty et al., 2013; Laberge et al., 2000; Mason & Pack, 2005). There have been various studies and surveys conducted to determine the prevalence of sleep terrors and how they vary based on different criteria for children. Based on a recent sample of 480 children between the ages of 6 to 11, 6.3% had experienced more than 5 sleep terrors per month (Goodwin et al., 2004). Thus, this leads us to understand that due to children having more slow-wave sleep compared to adults, they are easily susceptible to sleep terrors during their childhood. The overall prevalence of sleep terrors can range with age from 1% in the elderly to 6.5% in children (Nguyen et al., 2008).

<u>Etiology and Treatment:</u> Some major factors that may increase the frequency of these attacks include sleep

deprivation, anxiety, epilepsy, excessive physical activity, illicit drugs, some medication, and a large intake of caffeine or alcohol (Van Horn & Street, 2023). There is no specific treatment that is effective for sleep terrors but the most critical method is providing comfort and support for the patients to make them feel safe, especially children. Children who suffer from conflict, excessive stress, or trauma are recommended specific coping techniques and therapy as these experiences may greatly influence the occurrence of sleep terrors (Van Horn & Street, 2023). These techniques may not only help to reduce the frequency of the episodes, but they may also prevent the child from having to encounter sleep disorders in the future. Sleep deprivation is a major cause of sleep terrors so it is vital that the children are able to maintain good sleep hygiene and habits with appropriate sleeping environments. According to the *American Academy of Sleep Medicine*, these are the recommended amounts of sleep on a regular basis for pediatric populations in order to promote optimal health (Paruthi et al., 2016).

- Infants - 4 months to 12 months should sleep 12 to 16 hours per 24 hours (including naps).
- Children 1 to 2 years of age should sleep 11 to 14 hours per 24 hours (including naps).
- Children 3 to 5 years of age should sleep 10 to 13 hours per 24 hours (including naps)
- Children 6 to 12 years of age should sleep 9 to 12 hours per 24 hours
- Teenagers 13 to 18 years of age should sleep 8 to 10 hours per 24 hours

However, other treatment options for moderate to severe cases include psychotherapy, relaxation therapy, autogenic training/hypnosis, and medication. For example, benzodiazepines such as clonazepam (typically used to suppress stages 3 and 4 of NREM sleep) may be used on a short-term basis at bedtime if sleep terrors are severe or frequent. The medication is most beneficial when it is taken at least 90 minutes before the child goes to sleep so the drug may be effective in the early hours of sleep (Leung et al., 2020; Mason & Pack, 2005, 2007). Additionally, tricyclic antidepressants (such as imipramine and amitriptyline), selective serotonin reuptake inhibitors (paroxetine and fluoxetine), ramelteon, and mirtazapine have also been used in cases with varying success. For frequently occurring sleep terrors, anticipatory awakening may be effective when it is performed around half an hour before the child is most likely to experience a sleep terror (Leung et al., 2020).

Confusional Arousals

<u>Diagnosis.</u> In arousal disorders, patients typically display recurrent episodes of incomplete awakening from sleep during the first third of the night. During this time, they would partake in limited associated cognition or dream imagery. They may also have partial or complete amnesia for the episode (Idir et al., 2022). Most arousal episodes are very brief as they last for about 5 minutes. However, some episodes may last as long as 40 minutes for children.

Confusional arousals are NREM sleep parasomnias that may stimulate sleep terrors and other parasomnias. Similarly to sleep terrors and somnambulism, confusional arousals occur during the transitional state in between stage three or four NREM sleep and wakefulness. In confusional arousals, individuals display behaviors of confusion without terror or ambulation. In most cases, the patient will abruptly open their eyes, raise their head, and look around in a state of surprise or fear. (Barros et al., 2020; Derry et al., 2009; Idir et al., 2022). The disoriented state may be accompanied by cries, whimpers, or mumbles. The episode is usually very brief and does not last for more than 10 minutes (Kotagal, 2009; Leo, 2003; Leung et al., 2020). Confusional arousals are not like regular self-oriented movements such as scratching the nose, rolling, or pulling on the sheets. They are more serious and sudden.

<u>Epidemiology and Treatment:</u> The prevalence rate of confusional arousals in children of age group 3 to 13 years is 17.3%. For children and adults who are 15 years and older, the prevalence rate is 6.9% (Bjorvatn et al., 2010). Usually, for confusional arousals, reassurance in children is the first line of treatment due to children outgrowing them over time. Preceding confusional arousal, there is an increase in slow-wave activity (SWA), which is commonly referred to as hypersynchronous delta (HSD). Normally, the density of SWA during the early sleep

cycles (Espa et al., 2000; Guilleminault et al., 2001; Irfan et al., 2021). A common nonpharmacologic treatment for confusional arousals is scheduled awakening. Due to the events of confusional arousal typically occurring during the first third of the night, waking the child 15 to 20 minutes before the usual time of arousal occurrence can help to avoid the event, due to an altered sleep state (Attarian, 2010; Kotagal, 2009). Despite there being no specific pharmacologic management techniques for confusional arousals, anecdotal evidence suggests that tricyclic antidepressants such as imipramine, clomipramine, and low doses of clonazepam may help (Leung et al., 2020).

REM Parasomnias

RBD (REM Sleep Behavior Disorder)

Diagnosis: REM sleep behavior disorder or RBD is a parasomnia that is characterized by a loss of muscle atonia during REM sleep. This would result in undesirable motor activity during REM sleep where individuals "act out their dreams" (Jozwiak et al., 2017). These abnormal behaviors and dream enactments may lead to injury based on the patient (Dauvilliers et al., 2018). RBD can be separated into two main groups which are idiopathic RBD and symptomatic RBD. The disorder is considered to be idiopathic when disassociated with neurological disorders but is considered symptomatic when other underlying causes such as autoimmune or inflammatory disorders, provoking antidepressant medication, or brain lesions, are present (Olson et al., 2000; Postuma et al., 2009; St Louis & Boeve, 2017; Teman et al., 2009).

Epidemiology: RBD is commonly associated with neurodegenerative diseases which include synucleinopathies such as Parkinson's disease, dementia, and multiple system atrophy (St Louis & Boeve, 2017). Additionally, it is more common with older community-dwelling men (aged 60 to 99) compared to women. However, in older adults (aged 50 years and below), RBD is seen to be equally frequent in men and women (Bonakis et al., 2009; Fernández-Arcos et al., 2016). RBD is also seen to be 5-fold more likely to develop in patients who receive antidepressants and 10-fold more likely to develop in patients with a psychiatric diagnosis (Teman et al., 2009). As RBD is common in Parkinson's patients, the many risk factors including previous injury, pesticide exposure, and education levels are similar.

REM Sleep Behavior Disorder in Parkinson's Patients: Parkinson's disease (PD) is a neurodegenerative condition that is characterized by various motor and nonmotor symptoms which include sleep dysfunction and cognitive decline. It is most impactful in the cognitive domains of attention, episodic learning and memory, visuospatial abilities, and executive functions (Aarsland et al., 2011; Dubois et al., 2007; Jozwiak et al., 2017). PD is also associated with neurobehavioral disorders (depression, anxiety), autonomic dysfunction (orthostasis, hyperhidrosis), and cognitive impairment (dementia) (Beitz, 2014).

REM sleep behavior disorder impacts 33% to 46% of patients with Parkinson's disease based on a polysomnography diagnosis (Sixel-Döring et al., 2011). In a study conducted to determine the correlation between RBD and PD, 180 Parkinson's patients were monitored on a one-night polysomnography (PSG) recording in a sleep laboratory. Eye movements, oral and nasal airflow, thoracic and abdominal movements, and more were recorded. Following this was a neuropsychological assessment including various tests evaluating various cognitive domains including attention, memory, episodic learning, and more. The results at the end of the studies presented that there is a strong association between RBD and PD. It was found that patients with RBD onset prior to Parkinson's diagnosis were at a higher risk of poor cognitive function. Additionally, the results presented that RBD in PD patients is a significant risk factor for the development of dementia (Anang et al., 2014; Fereshtehnejad et al., 2015; Nomura et al., 2013). RBD in PD also presented a more impaired cognitive profile and mild cognitive impairment (MCI) diagnosis frequency, leading to an increased rate of neurodegeneration (Jozwiak et al., 2017).

Treatment: The main pharmacological treatments for RBD are melatonin and clonazepam as both have been shown to reduce the frequency of RBD behaviors. However, melatonin has proven to be more effective as it has fewer adverse effects and better tolerability for patients compared to clonazepam (McCarter et al., 2013). Melatonin therapy is especially used in cases involving sleep apnea and memory problems where the starting dose is 3 mg but may slowly increase to the range of 6 to 12 mg at bedtime. However, some effects that may be present based on the dosage are headache and daytime sleepiness (Brooks & Peever, 2012; Esaki et al., 2016; Kunz & Mahlberg, 2010). Based on a randomized trial evaluating the effects of melatonin on the percentage of REM sleep without atonia, 8 males with a mean age of 54 years reported symptoms of RBD per the International Classification for Sleep Disorder (ICSD). After proper diagnosis and testing, it was reported that the ingested melatonin decreased the percentage of REM sleep without atonia from 39.2% to 26.8% (McGrane et al., 2015).

Clonazepam is also an effective treatment for RBD, however, it does not work as effectively as melatonin when it comes to reducing REM sleep without atonia (RSWA). Instead, clonazepam would act to control complex motor behaviors. On the contrary, clonazepam use may worsen obstructive sleep apnea and cognitive impairment which could be detrimental to the elderly. This is why clonazepam dosage should be controlled, starting at 0.25 to 2 mg at bedtime (Li et al., 2016; Schenck & Mahowald, 1996; St Louis & Boeve, 2017).

Nightmare Disorder

Diagnostic Criteria (According to the ICSD-3 and DSM-5): Nightmare disorder is classified as a rapid eye movement (REM) sleep-related parasomnia according to the International Classification of Sleep Disorders 3rd Edition (ICSD-3). They include recurring nightmares which cause distress to those who suffer from the disorder. Nightmare disorder patients struggle with a fear of going back to sleep as the content of their nightmares is remembered upon awakening. Based on the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5), nightmare disorder includes repeated occurrences of extended, extremely dysphoric, and well-remembered dreams that usually involve efforts to avoid threats to survival, security, or physical integrity and that generally occur during the second half of the major sleep episode. Upon awakening from the nightmare, the patient is very alert and oriented where they feel significant impairment in functioning areas. Additionally, various medical conditions and traumatic experiences have been associated with nightmare disorder as risk factors. This includes alcohol, several classes of drugs including SSRIs and beta-blockers, post-traumatic stress disorder (PTSD), and other sleep disorders, with REM sleep behavior disorder (RBD) and narcolepsy, being significant (Högl & Iranzo, 2017; Sandman et al., 2015; Stefani & Högl, 2021).

Polysomnography for Nightmare Disorder: Usually when diagnosing nightmare disorder, the use of polysomnographic confirmation isn’t required, however, it should be performed in cases of REM behavior disorder (RBD) and narcolepsy. After an extensive review of nightmare disorders, it was found that patients usually experience more frequent awakenings and disturbed sleep (Germain & Nielsen, 2003; Stefani et al., 2019). As nightmares are common for children, a thorough diagnosis should be performed before evaluating nightmare disorders in children. It should also be noted whether other family members experience nightmares.

Pathophysiology: Despite there still being a lot unknown on the pathophysiology of nightmare disorder, studies have proposed that there is an involvement of a dysfunction of a network that encompassed limbic, paralimbic, and prefrontal regions of the brain. This explains the changes in emotion regulation for patients who suffer from nightmare disorder (Nielsen & Levin, 2007).

It is also thought that chronic nightmares develop due to the interaction between elevated hyperarousal and impaired fear extinction. Hyperarousal is also common in insomnia and post-traumatic stress disorder

(PTSD) as they are related disorders that also present the occurrence of nightmares. As traumatic experiences and childhood adversity are common traits that facilitate both hyperarousal and impaired fear extinction, it is crucial that they are considered when diagnosing patients for nightmare disorder (Germain & Nielsen, 2003).

Epidemiology: As it is difficult to distinguish between common nightmares and nightmare disorders, it could be challenging to determine the prevalence of nightmare disorders. According to studies on the adult population in Austria and Finland, it was reported that sporadic nightmares were frequently impacting 22% of the general adult population in Austria (Zeitlhofer et al., 2010) and 36.2% of men and 45.1% of women in Finland (Sandman et al., 2013). Another study from an American public university presented that nightmares were more frequent in children compared to adults, with 14% of students reporting experiencing frequent nightmares (Nadorff et al., 2011).

Nightmare disorder was also reported to be frequent for patients suffering from other disorders and illnesses including psychiatric disorders, depression, post-traumatic stress, and schizophrenia. A systematic review of 22 studies reported that nightmare disorder is prevalent in 66.7% of PTSD, 37.3% of mood disorders, 31.1% of personality disorders, and 15.6% of anxiety disorders (Stefani & Högl, 2021; Swart et al., 2013).

Evaluation: When evaluating nightmare disorder a detailed analysis of the patient's sleep history is required. This should be accompanied by questions that examine previous possible psychiatric disorders, history of medication and substance intake, and experience with symptoms of other parasomnias including sleep paralysis, somnambulism/sleepwalking, and dream enactment behavior (Stefani & Högl, 2021; Zergham & Chauhan, 2023). As trauma-induced nightmares are quite common in relation to nightmare disorder, possible trauma should be diagnosed as posttraumatic nightmares present more elicit emotions with severe arousal, helplessness, and strong aggression. If it is believed that the nightmare disorder is associated with other disorders such as REM sleep behavior disorder (RBD), a polysomnography and other imaging tests should be performed to review the severity of the disorder for the patient.

Treatment: As nightmare disorder is commonly associated with post-traumatic stress disorder, the typical first line of treatment that has shown to be beneficial is prazosin 1–3 mg at bedtime. Prazosin has been the common pharmacological treatment for PTSD-associated nightmares since it has been shown to be effective against PTSD symptoms and sleep disturbances (Aurora et al., 2010; Högl & Iranzo, 2017; Reist et al., 2021).

For non-pharmacological treatment, chronic repetition of nightmares is usually combated through exposure therapy or imagery rehearsal therapy (IRT). IRT has been proven effective against PTSD-induced nightmares as well and has been the recommendation of the American Academy of Sleep Medicine. IRT is a method of management where the patient is encouraged to log their nightmares and then rewrite their ending with a more positive outcome. IRT has been proven to help children struggling with recurring nightmares and nightmare disorders (Gieselmann et al., 2019; Morgenthaler et al., 2018; Stefani & Högl, 2021). Another approach is lucid dreaming therapy which focuses on encouraging the patient to directly influence their dreams. It enables individuals to take action by having awareness of their dreams and making decisions to change the dream plot. This makes it easier for the dreamer to have control over their dream content and improve their recollection of the dream upon awakening (Gieselmann et al., 2019).

Discussion

Limitations

Throughout my research on the topic of sleep disorders and parasomnias, I came to understand that there is a lot unknown. Despite there being thorough research in sleep medicine regarding the classification of disorders and the necessary steps taken to evaluate and perform a proper diagnosis, there is still a lot to learn when it comes to treatment. For pharmacological and non-pharmacological intervention, it is clear that there aren't concrete methods of treatment for sleep disorders that are suitable for everyone. Today, there are a lot of therapies that are being prioritized over medication as there is still a lot to learn about the side effects and symptoms of these medications. Most importantly, I found that there is also a limited understanding of the pathophysiological processes behind these disorders since we have yet to fully grasp the capabilities of the brain and how it performs during sleep. Take nightmare disorder for example, since nightmares are very common, it is quite difficult to properly diagnose and differentiate between the regular occurrence of nightmares and the possibility of nightmare disorder.

Conclusion

It is crucial to understand the processes behind sleep disorders and their impact on human health as sleep is a function needed for the growth and development of every living being. As there are a plethora of disorders that prevent proper sleep, we must understand how they can be avoided through treatment, whether it be non-pharmacological or pharmacological. The structure and outline of this review were organized in a way to properly analyze these various parasomnias and characterize them into REM and NREM sleep. In terms of treatment, since there is no single method of globalized treatment for parasomnias, we should focus our efforts on further developing proper individual planning for patients who can recover successfully from sleep disorders. Research focusing on the pathophysiology of parasomnias has immense potential for future therapy and prevention techniques that may be vital to further grasping the extent of our brain activity. My experience researching this topic not only allowed me to further expand my knowledge in sleep science, but also to truly understand the complexities of the brain. This opportunity allowed me to properly understand the significance of sleep medicine and how much there is to discover.

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