Review

Relationship between Sleep Disturbances and Chronic Pain: A Narrative Review

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Review

Relationship between Sleep Disturbances and Chronic Pain: A Narrative Review

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Abstract: Sleep disturbances and chronic pain are prevalent and interrelated conditions that significantly impact individuals' quality of life. Understanding the intricate dynamics between sleep and pain is crucial for developing effective treatments that enhance the well-being of affected individuals and reduce the economic burden of these debilitating conditions. This narrative review examines the complex relationship between sleep disturbances and chronic pain. We describe the prevalence and types of sleep disturbances and sleep disorders in chronic pain patients. Posteriorly we critically review the clinical and experimental evidence investigating the relationship between sleep disturbances and chronic pain aiming to clarify the impact of chronic pain on sleep and, conversely, the impact of sleep disturbances on pain perception. We conclude that a bidirectional relationship between chronic pain and sleep disturbances is almost a consensus in the literature, however, the strength of each direction of the association is less clear. As of now, the literature suggests that sleep impairment is a stronger predictor of pain than pain is a predictor of sleep impairment. Additionally, addressing sleep disturbances in chronic pain patients is crucial, as poor sleep has been linked to higher levels of disability, depression, and pain-related catastrophizing.

Keywords: bidirectional relationship; chronic pain; polysomnography; sleep disorders; sleep disturbances

1. Introduction

Human sleep is a naturally recurring state of mind and body characterized by altered consciousness, relatively inhibited sensory activity, reduced muscle activity, inhibition of nearly all voluntary muscles during rapid eye movement (REM) sleep, and reduced interactions with surroundings [1]. It is a vital, restorative process that allows the body and mind to maintain homeostasis, develop, and optimize function across multiple physiologic systems [1,2]. Sleep disturbances encompass a range of disorders that disrupt the normal sleep cycle, including insomnia, narcolepsy, sleep apnea, restless legs syndrome (RLS), and circadian rhythm disorders [3,4]. The prevalence of sleep disturbances in the general population varies widely across different populations and conditions [3–7]. For instance, the prevalence of sleep-disordered breathing (SDB) ranges from 9.0 – 83.3% in men and 4.0 – 76.6% in women [4]. Insomnia affects approximately 22% [7], narcolepsy affects 0.04 – 0.1% [3,6], and obstructive sleep apnea (OSA) impacts from 9% – 38% of the adult population [5]. Sleep disturbances are associated with a myriad of negative health outcomes including cognitive dysfunction, immune dysregulation, and increased risk of cardiovascular disease, diabetes, and obesity [8,9].

Pain is a complex and multifaceted phenomenon defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage [10]. Chronic pain is defined as pain that persists or recurs for more than three months [11]. Chronic pain often lasts beyond the usual course of an acute illness or healing of an injury and can continue despite the absence of an obvious injury or disease [11]. The prevalence of chronic pain in the adult population is estimated to be between 19.2 – 41.4% with rates up to 76.2% in the elderly [12–14]. The incidence of chronic pain and severe chronic pain in the USA was recently estimated as 52.4

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and 12.0 cases per 1000 person-years, respectively [15]. This incidence is greater than other common chronic conditions such as diabetes, hypertension, and depression [15]. The economic burden of chronic pain is substantial, encompassing healthcare costs, lost work productivity, and decreased quality of life [16]. As with sleep disturbances, chronic pain is also associated with similar negative health outcomes including cardiovascular diseases, cerebrovascular events, cognitive impairment, psychiatric diseases and disability [2,17].

Consequently, sleep disturbances and chronic pain are prevalent health issues that can independently impact individuals' quality of life and overall well-being. However, clinical and experimental studies have also consistently shown that sleep disturbances and chronic pain have a complex relationship that may exacerbate the severity and impact of each other [18–20]. In the present work, we critically review the clinical and experimental evidence investigating the relationship between sleep disturbances and chronic pain aiming to better answer some fundamental questions that have been puzzling the field since its inception: 1) What are the prevalence and types of sleep disturbances and sleep disorders in chronic pain patients?; 2) What is the impact of chronic pain on sleep?; and, 3) What is the impact of sleep disturbances on pain perception? The answers to these questions are of paramount importance as unraveling the complexities of the interaction between sleep and pain can allow the development of more effective approaches to improve the health and well-being of those affected by these debilitating conditions and potentially significantly decrease the economic burden caused by these diseases.

2. Prevalence and Types of Sleep Disturbances and Sleep Disorders in Chronic Pain Patients

There is no clear definition of the term sleep disturbance in the literature [19,21–23]. In general, sleep disturbance refers to any disruption in the quality, quantity, or timing of sleep and many times are suggestive of insomnia in broad sense. It can be occasional or frequent and might not necessarily indicate a medical condition. On the other hand, sleep disorders are specific medical conditions that consistently impair the ability to sleep well on a regular basis. They are typically diagnosed based on established criteria and often require medical or psychological intervention.

Some studies have explored the prevalence and types of sleep disturbances in patients with chronic pain [2,19,20,24,25]. An increased prevalence of sleep disturbances when compared with the general population was found in patients with different chronic pain syndromes including chronic low back pain [26], orofacial pain [27], chronic joint pain [28], cancer-related pain [29–31], headaches [32], and fibromyalgia [25]. Therefore, in general, individuals with chronic pain have a higher risk to present or develop sleep disturbances [2,19,20,24]. Furthermore, chronic pain patients with concurrent sleep disturbances are more likely to have greater disability, psychological distress, depression, catastrophizing, anxiety, suicidal ideation, and be less physically active [21,33,34].

The prevalence of sleep disturbances in chronic pain patients varies widely across different study populations ranging from 40% – 88% [19,20,22]. The significant variability in prevalence estimates across studies may stem from differences in sample size, study design, and methodologies such as objective vs subjective sleep assessments [2]. Objective sleep assessment with polysomnography is generally regarded as the ‘gold standard’, as opposed to self-reported measures, which are prone to inaccurate recall, the common expectation that pain disrupts sleep, and the high likelihood of memory and response biases [2,22]. Additionally, the predisposition to develop sleep disorders may differ based on the type of chronic pain syndrome the patient experiences. For example, musculoskeletal conditions are frequently associated with sleep issues with prevalence of up to 65% in rheumatoid arthritis,70% in osteoarthritis, and 95% in fibromyalgia [19].

Insomnia appears to be the most common sleep disorder in chronic pain patients, with a prevalence ranging from 24 – 72% [21,22]. Restless legs syndrome (20 – 65.7%) and sleep disordered breathing (10 – 83%) appear to come closely together in second [21,22]. It is unclear if other sleep disorders such as narcolepsy and parasomnias are more prevalent in patients with chronic pain when compared with the general population.

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3. The Impact of Sleep Disturbances on Pain Perception

Sleep-deprived healthy subjects, in particular slow wave sleep restriction, show increased self-reported musculoskeletal pain, fatigue, and evoked pain responses obtained through somatosensory testing protocols (e.g. heat pain thresholds, pressure pain thresholds, or laser-evoked pain) when compared with healthy control subjects [2,35–37]. There is also evidence showing that sleep deprivation produces or increases hyperalgesia in patients with acute pain and chronic pain [28,38–40]. Conversely, studies show improvement in pain threshold after improvement of sleep quantity or quality [41,42]. However, it is argued that results coming from experimentally induced sleep disturbances do not reproduce the experience of waking several times each night for prolonged periods as well as long-term reduced sleep quality that is present in chronic pain patients [43].

Prospective longitudinal studies focusing on the effect of sleep on future pain in healthy and chronic pain patients sought to address this problem and have reported similar findings. A prospective population study following patients with no pain at baseline for over 5 and 18 years identified that problems with initiating sleep, maintaining sleep, early awakening, and nonrestorative sleep predicted the onset on chronic widespread pain [44]. Preoperative sleep disturbances are associated with increased postoperative acute surgical pain [38–40] and are a risk factor for chronic post-surgical pain [45]. Insomnia has been shown to be a risk factor for the development of musculoskeletal pain, back pain, headache, and osteoarthritic pain [26,46–49]. Patients with sleep disordered breathing, narcolepsy, and sleep bruxism also have an increased prevalence of chronic pain [21,23]. Like insomnia, there is some evidence that narcolepsy is a risk factor for musculoskeletal pain, chronic low back pain, migraine and tension type headache [50–52]. However, studies investigating the temporal relationship between sleep disordered breathing and chronic pain are rare [23]. Consequently, there is no strong evidence that sleep disordered breathing is a predictive factor for chronic pain development. Sleep disturbances can also increase pain intensity, pain sensitivity, and duration of pain in chronic pain patients [2,24,25,53,54]. Furthermore, sleep disturbances may contribute to the maintenance of symptoms in patients with chronic pain [55–57].

Studies also report that the treatment of sleep disturbances and disorders can improve chronic pain [2,58–60]. For example, sleep improvement by cognitive behavioral therapy predicts long term pain improvement in patients with comorbid osteoarthritis and insomnia [61]. In accord, chronic low back pain patients with sleep disturbances that resolved at follow-up were more likely to report recovery and lower pain intensities at six months [62].

Taken together this evidence indicates that sleep disturbances and sleep disorders can trigger or exacerbate pain intensity and functional impairment in chronic pain patients [23,55,63].

4. The Impact of Chronic Pain on Sleep

Studies analyzing the impact of chronic pain on sleep are less definitive than the ones analyzing the impact of sleep disturbances on chronic pain [2,21–23,33]. Some studies have assessed sleep via polysomnography in acute post-surgical pain conditions [64]. Patients after surgery demonstrate reduced total sleep time by up to 80%, decreased or absent REM sleep, and fragmentation of sleep with frequent arousals and awakenings for the first two post-operative nights [65–68]. They also show reduced duration of slow wave sleep for up to four nights [65]. While sleep is clearly disrupted in the post-operative period, determining the causal role as post-surgical pain is extremely difficult. Several factors may contribute to post-operative sleep disturbance including hospital-related environmental factors, the stress response to the surgical insult, and medications used during the post-operative recovery [64].

Sleep disturbances found in patients with chronic pain include longer sleep-onset latency, more frequent and longer awakenings after sleep onset, unrefreshing sleep, shorter total sleep time, lower sleep efficiency, and poorer sleep quality [27,33,69,70]. This indicates that patients with chronic pain have less sleep time, take longer to fall asleep, and spend more time awake. Additionally, a recent meta-analysis found that chronic patients spent more time in the first stage of sleep during the non-NREM phase [22].

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Most of the polysomnographic studies showing alterations during sleep in chronic pain were done on fibromyalgia, arthritis and chronic fatigue syndrome patients [22,71]. Polysomnography shows a reduction in the amount of slow wave sleep, REM sleep, and total sleep time associated with an increase in the number of arousals in patients with fibromyalgia when compared to age-matched healthy patients [72,73]. In addition, patients with arthritis and chronic fatigue syndrome exhibit alpha intrusions into slow wave and non-NREM sleep that are correlated with objective measurements of pain [28,71,74]. In contrast, there is conflicting data regarding alpha intrusions in sleep in patients with fibromyalgia [75]. Treatment of sleep disturbances leading to reductions of alpha sleep intrusions also results in lower levels of pain in these patients [60,61,71,74]. Although not a consensus in the literature, patients diagnosed with chronic fatigue syndrome also present reductions in sleep efficiency and REM sleep [74]. More recently, Orzeszek and colleagues showed no significant association between severity of pain and polysomnographic sleep parameters in patients with chronic orofacial pain, suggesting that this relationship does not appear to be present in all chronic pain conditions [27].Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

Sleep disturbances and disorders are common and significant issues in chronic pain patients that can significantly impact their quality of life and pain outcomes. Sleep disturbances manifest in various forms and are associated with increased pain severity, longer pain duration, greater levels of anxiety and depression, and impaired physical and psychosocial functioning.

A bidirectional relationship between chronic pain and sleep disturbances is almost a consensus in the literature, however, the strength of each direction of the association is less clear. As of now, the literature suggests that sleep impairment is a stronger predictor of pain than pain is a predictor of sleep impairment [2,21–23,33].

Addressing sleep disturbances in chronic pain patients is crucial, as poor sleep has been linked to higher levels of disability, depression, and pain-related catastrophizing [21,22,26,76]. Furthermore, the treatment of comorbid sleep disturbance and sleep disorders in chronic pain patients has the potential to improve outcomes. This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

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