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ORIGINAL

STUDYING THE LINKAGE BETWEEN INSOMNIA AND POST-OPERATIVE PAIN IN ATHLETES IN TURKEY

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ABSTRACT

This study investigated the relationship between Insomnia and Post-Operative Pain (POP) in Athletes. We conducted a case-control study on individuals who had undergone microscopic lumbar discectomy. Based on their Insomnia Severity Index (ISI) ratings, participants were separated into two groups: insomnia groups (n = 35) and control groups (n = 35) for those with an ISI score of 7 or higher. Following 1, 2, 4, 8, 12, and 18 hours after surgery, all subjects were asked to rate their pain on a numeric rating scale (NRS). We selected athletes with a history of microscopic lumbar discectomy to reduce the possible impact of sleep deprivation on acute postsurgical pain in athletes due to changes in operative pathophysiology and techniques. Age, gender, BMI, American Society of Anesthesiologists score, and duration of surgery were comparable between groups. The subjects with insomnia had higher NRS scores and significantly more post-operative tramadol and rescue analgesia requirements than the controls. According to the covariant analysis, insomnia greatly affected the mean NRS score and strongly correlated with preoperative pain. In individuals undergoing microscopic lumbar discectomy, insomnia may serve as an effective predictor of acute POP, according to the findings of this study.

KEYWORDS: pathophysiology, microscopic investigated, POP

1. INTRODUCTION

Insomnia is a symptom of poor sleep patterns. When suffering from insomnia, a person may have difficulty falling asleep, staying asleep, and obtaining restful sleep. This occurs regardless of whether a person has access

to and the ideal conditions for restful sleep. Insomnia can make it challenging to perform daily tasks and lead to daytime fatigue (L.a.B.I., 2022). When the ability to feel or perform is impaired owing to insufficient or poor-quality sleep, a person is diagnosed with insomnia. 10% of the population suffers from a medically-diagnosed case of sleeplessness. It can be treated in numerous ways, including with medications and mental health services, and is often harmless (C. clinic, 2023). Sleeplessness is a significant issue for professional athletes (Gerber et al., 2022). Many individuals eventually have relatively brief (acute) insomnia, which can continue for several days. Typically, anxiety or a stressful situation is the cause. Yet, many people have persistent long-term insomnia, which often lasts for a lengthy period. Insomnia may be the primary reason, although it may also be related to other diseases or drug interactions (M. Clinic, 2023). Several individuals have chronic insomnia due to anxiety, traumatic experiences, or sleep-disruptive behaviors. Insomnia can be cured by addressing the underlying reason, but it may occasionally recur for months. Among the potential causes of chronic insomnia include diseases and drug use. The medical issue may be treated, resulting in improved sleep, but insomnia may persist.

Participating in competitive sports and athletic events provides numerous benefits for young people. It is estimated that over 50 million children between the ages of 6 and 18 participate in organized sports, and almost one-third suffer serious injuries that compel them to miss a practice or a tournament each year (Fabricant, 2018). Every patient is unique, and every individual has a particular pain management strategy. Some individuals recover faster than others. Good practices, such as employing ice, taking the appropriate medicines, and obtaining sufficient rest, offer the highest chance for a complete recovery with the least suffering. Around 2,6 million children and adolescents yearly sustain an athletic injury, a rising trend among athletes. As a result of severe athletic injuries and surgically rectifying these damages, young athletes and their family members experience considerable pain and emotional distress (Liu & Lin, 2019). It is crucial to managing pain symptoms following athletic injuries and medically correct physical injuries to prevent the development of serious conditions and protect elite athletes from additional psychological stress. Not all patients suffer comparable sleep difficulties after surgery. Intensive care unit patients often experience sleep difficulties. Even more intrusive procedures, such as major operations, usually result in severe sleep issues. Yet, problems falling asleep after surgery may result from various factors(Adams & Lasseigne, 2018; Youssef & Webster, 2022).

Post-operative pain (POP) is the clinical term for various uncomfortable psychological and sensory events that may or may not be accompanied by autonomic and behavioral changes (Cascella, 2022). When abused and prolonged, these complicated immunological processes, whose basic purpose is maintaining body temperature, can produce physiological, mental, and

behavioral changes such as stress, sleeplessness, and depression. If not appropriately addressed, POP can develop into a complicated chronic pain issue (Glare, Aubrey, & Myles, 2019). The clinical manifestations of POP might vary substantially from individual to individual. In addition to the surgical procedure's type and degree of severity, they are affected by the patient's physiology and any pre-existing conditions. Many factors, including emotional, economic, cultural, and religious factors, may influence the clinical manifestations of suffering. Complex interactions of a large number of controllable factors cause post-operative insomnia. If left untreated, post-operative sleeplessness can lead to increased sickness and delayed healing (Rampes, Ma, Divecha, Alam, & Ma, 2020). Although pain remains the most common cause of nocturnal post-operative disruptions (Dolan, Huh, Tiwari, Sproat, & Camilleri-Brennan, 2016), analgesics are the most effective medication for returning to sleep. Opioids are useful for relieving surgical pain but exacerbate post-operative sleeplessness by decreasing REM-triggering awareness and waking reflexes. The purpose of this study is to evaluate the relationship between Insomnia and Post-Operative Pain in Athletes.

Young athletes are not an exception to the rule that children and adolescents require adequate sleep for physical and cognitive development. Children participating in sports may benefit even more from establishing appropriate sleep habits. Teens and young adults who receive sufficient sleep perform better in sports and have fewer injuries. On the other hand, teenagers who do not get enough sleep are still more prone to become ill or injured and battle issues such as depression and anxiety. On average, sleep conditions throughout the world are poor. Poor sleeping patterns and diagnostic sleep abnormalities, such as insomnia and sleep-disordered breathing, are associated with adverse health outcomes, such as high blood pressure, diabetes, dementia, psychological impairment, and cognitive disorders. Insufficient rest decreases sports performance, slows recuperation, and increases the risk of injury in athletes (Bolin, 2019). Despite substantial advances in understanding what causes underlying pain and how to alleviate it, post-operative pain management remains a major medical issue. Post-operative sleeplessness is a common complaint among post-operative patients. Major alterations in post-operative sleep patterns include interruption, a decrease in total sleep duration, and a decrease in slow-wave and rapid-eye-movement sleep (Chouchou, Khoury, Chauny, Denis, & Lavigne, 2014). Clinical and experimental data reveal that while pain and opioid drugs decrease sleep, insomnia may exacerbate the pain. Surgical trauma appears to impact both sleep disruptions and pain threshold significantly. On the other hand, sleep disruptions may worsen pain, while pain and opioid analgesics may enhance sleep disturbances. Unfortunately, nothing is known about the relationship between post-operative sleeplessness and pain. Several scientific studies and clinical investigations have linked sleep disturbance and hyperalgesia. Sadly, nothing is known regarding the relationship between acute post-operative pain

and insomnia problems. This research will help clarify the relationship between insomnia and POP in athletes.

2. REVIEW OF LITERATURE

2.1 Impact of Insomnia on Post-Operative Pain

Insomnia is a debilitating disorder characterized by difficulty falling asleep, staying asleep, sleeping poorly, and poor work performance. Between 6% and 10% of the population suffers from insomnia, the most widespread form (Lin et al., 2022). Increased sleep efficiency and duration are associated with enhanced pain management in patients. A shorter hospital stay may be associated with hospitalized individuals sleeping better. Some hospital-related factors may lead to insomnia, but specific patient-related difficulties must also be recognized as potential causes. Pain has been connected to sleep disorders. Poor sleep has been associated with heightened pain perception (A. Miller, Roth, Roehrs, & Yaremchuk, 2015). There is a high likelihood that you may have discomfort, sleep difficulties, and medical care throughout a typical lifespan.

Post-operative pain is still a prevalent problem, and growing evidence indicates a relationship between pain and insomnia. There is a broad consensus that sleep and pain are reciprocal. Reduced sleep habits increase the likelihood of acquiring pain and exacerbate existing pain. There are many parallels between the symptoms of developing sleeplessness and experiencing severe post-operative pain (Sipilä & Kalso, 2021). Similarities exist between the onset of sleeplessness and pain, such as negative expectations and cognitive discomfort. If a patient has insomnia and post-operative healing difficulties, the physiological systems involved may not recover as efficiently (Herrero Babiloni et al., 2020). There is a broad consensus that sleep and pain are reciprocal. Decreased sleep patterns increase the likelihood of acquiring pain and exacerbate discomfort (Afolalu, Ramlee, & Tang, 2018). Because of reasons such as stress and surgical discomfort, poor post-operative sleeplessness can persist for days or even weeks after surgery (Chen et al., 2016). This may function as a trigger for the onset of prolonged insomnia symptoms. Excessive concern about the acute insomnia-related inability to sleep can further affect drowsiness. Individuals who had trouble sleeping before surgery are more likely to suffer from post-operative insomnia (Wang, Lu, Guo, Ren, & Zhang, 2019). Consistently, older individuals with a history of sleep disturbances and cardiovascular disease are more prone to experience post-operative insomnia.

2.2 Insomnia in athletes

Emotional health is a vital component of human health that interacts with sleep. Due to the taboo surrounding sleep and emotional problems, they are frequently overlooked and unrecognized in athletics. According to research,

sleep, and behavioral difficulties affect athletes significantly more than the general population (Montero, Stevens, Adams, & Drummond, 2022). It is commonly believed that ample, high-quality sleep improves psychological and physical recovery after rigorous workouts, lower the risk of injury, and prevents game-day weariness and attention lapses (Kirschen, Jones, & Hale, 2020).

Insomnia has extra expenses for athletes, including lower sports performance, slowed recuperation, and an increased risk of injury. Typically, athletes receive less sleep than they require, and the sleep they do get is of poor quality. Their inconsistent sleep patterns are exacerbated by their exercise regimens, tournament schedules, and travel (Nedelec, Aloulou, Duforez, Meyer, & Dupont, 2018). Professional athletics can increase tension, anxiety, and apprehension, resulting in sleep deprivation and poor sleeping patterns. As a result of sports-related activities that disrupt sleep, insomnia may be clinically diagnosed. As a result, sleep problems are prevalent among athletic communities (Silva et al., 2019).

Sleep has been related to all aspects of sports performance, including training, competition, and rehabilitation. This has led to a greater emphasis on sleep patterns in athletes in experimental research (Lastella, Memon, & Vincent, 2020). In the past decade, awareness of the significance of sleep for an athlete's practice, recuperation, performance, and health has increased in nearly every professional athletic field. Athletes in the professional ranks are subject to additional requirements that enhance the likelihood of sleeplessness. These demands include constant travel, which produces physiological disruption and misalignment, hard training regimens, and severe tournament-related stress and anxiety (Cook & Charest, 2023). It has been established that sleep has a moderating effect on an athlete's injury risk and ability to recover quickly and effectively from an injury. In addition to being a primary risk factor for concussions in sports (Oyegbile, Dougherty, Tanveer, Zecavati, & Delasobera, 2020), it has been found that insomnia harms the severity of injuries, recuperation rates, and eventual treatment response.

Professional athletes are more susceptible to sleep disturbances, correlated with insufficient sleep duration and frequent awakenings. At least one night of sleep restriction decreases athletic performance. However, it is unknown how partial sleep restriction over a longer period of time, such as one to three nights, can affect performance (Walsh et al., 2021).

Before a competition, sleep disturbances are a common occurrence that can negatively impact athletic performance. Considering the great variety of study techniques, demographics, locations, measurement devices, and published results, it might be difficult to determine the impact of sleep disturbance on sports performance (Gupta, Morgan, & Gilchrist, 2017). Regular exercise, particularly at night and in the evening, has improved sleeping

patterns in healthy non-athletes, contradicting the assumption that evening exercise is detrimental to sustaining healthy sleep habits (Chennaoui, Arnal, Sauvet, & Léger, 2015). While calorie restriction or high-fat meals can disrupt sleep architecture, insomnia can alter glucose uptake, increasing the risk of obesity and type 2 diabetes.

3. METHODOLOGY

We conducted this prospective observational case-control study on patients scheduled for appointive microscopic lumbar discectomy at the Meram Faculty of Medıcıne Hospıtal between January 2016 and November 2017 with permission from the institutional ethics committee and written consent from all participants. Athletes with renal failure, thyroid dysfunction, morbid obesity, obstructive sleep apnea, neurologic dysfunction, or alcoholism were excluded, as were those on antidepressants, those scheduled for emergency surgery, and those taking anticonvulsants or opioids. Patients responded to the Turkish 7-item Insomnia Severity Index (ISI) questionnaire to identify their insomnia's nature, severity, and impact (Bastien, Vallières, & Morin, 2001; Boysan, Gulec, Besiroglu, & Kalafat, 2010).

Analyzed dimensions were the intensity of sleep start, persistence, early hours awakening issues, sleep discontent, disruption of sleep issues with physical functioning, observability of sleep difficulties by others, and discomfort resulting from sleep disruptions. Each item was assessed on a 5-point Likert scale ranging from 0 (no problems) to 4 (very severe problems), resulting in a total score ranging from 0 to 28. The results were categorized as follows: no insomnia (0–7), subthreshold insomnia (8–14), moderate insomnia (15–21), and severe insomnia (22+). (18–30). Based on their responses to the ISI questionnaire, the patients were separated into two distinct groups. The insomnia group consisted of 35 patients with sleep problems lasting more than three months and moderate to severe insomnia (ISI >14). In comparison, the control group comprised 35 patients with an ISI score of 7.

To evaluate the preoperative pain experience, patients were asked if they had had any pain in the previous month that lasted for a single day or longer. Before surgery, if the pain was reported based on the patient's pain history, the patient was asked to characterize the pain on a two-sided blank body manikin (2 front and rear). These descriptions were documented as preoperative pain encounters. A different anesthesiologist, ignorant of the group assignment, assessed post-operative pain. To assess post-operative pain, participants were asked to rate their abdomen pain using a numeric rating scale (NRS; 0 = no pain; 10 = the worst pain conceivable) at 1, 2, 4, 8, 12, and 18 hours after surgery. Patients were classified as experiencing moderate to severe pain if their average NRS score was less than 4. None of the patients were given any premedication. All patients were administered rocuronium 0.5

mg/kg, fentanyl 1 g/kg, and propofol 2 mg/kg for induction of anesthesia. No further intraoperative fentanyl was administered. Sevoflurane maintained anesthesia while oxygen and N2O were administered at 2 L/min each. During the surgeries, a standardized anesthetic technique was utilized.

All patients undergo post-operative pain therapy via an intravenous patient-controlled analgesia (PCA) device (CADD-Legacy Patient Control Analgesia Device Model 6300; Ambulatory Infusion Pump Smith Medical ASD, Dublin, OH, USA). Patient-controlled analgesia (PCA) is a method of pain management that enables individuals to manage their pain. In patient-controlled analgesia (PCA), a patient's intravenous (IV) catheter is directly connected to computerized equipment known as the patient-controlled analgesia pump, which carries a syringe of prescribed painkillers. In our study, the pump is programmed to deliver a small, constant flow of analgesia. Allowing the individual to press a button allows different drug dosages to be self-administered as needed. All participants get instructions on correctly using the device and pump during and after the procedure. Each pump contained 100 mL of 0.9% sodium chloride solution containing 300 mg of tramadol.

3.1 Eligibility Criteria

Based on the title and description, the researchers independently assessed the validity of the acquired data. If the original document's content was unclear, it was evaluated. Studies had to fulfill the following inclusion criteria:

1. The analysis revealed quantifiable sleep outcomes; 2. data for responders younger than 18. 3. information regarding participants at the professional level. The data acquired from athletes' patients intended for microscopic lumbar discectomy by appointment.

3.2 Statistical Analysis

The estimation of the sample size is based on a previous study. We hypothesized that the mean NRS scores in insomnia and control groups would be 3.6 and 2.0, respectively, with a standard deviation (SD) of ± 2.0. We computed the sample size for each group to be 32 (α = 0.05, β= 0.8). Consequently, 35 participants were assigned to each group to allow for a 10% attrition rate. Using the Shapiro-Wilk test, the normality of distributions was examined. The numerical data are presented as the mean and standard deviation, and the categorical data as the number (percent).

In addition, an analysis of covariance was done to determine the main impacts of insomnia, age, sex, BMI, and prior pain experience, as well as their interaction, on the post-operative mean NRS score. The statistical analysis used SPSS for Windows (version 21; IBM Corp., Armonk, NY, USA). A P-value

less than or equal to 0.05 was considered statistically significant.

4. RESULTS

Table 1 displays descriptive information on patients. There was no significant gender, age, BMI, operation time, or ASA physical classification differences across groups. Preoperative pain was more prevalent in the insomnia group compared to the control group (p=0.04).

In the sleeplessness group, nine patients had some pain, and four had widespread pain, while in the control group, two patients had some pain, and one had widespread pain. The post-operative NRS scores at 1, 2, 4, 8, 12, and 18 hours after surgery were significantly higher for the insomnia group than for the control group (Table 2). Table 3 demonstrates that the consumption of tramadol was substantially higher in the insomnia group (269.4 33 mg) than in the control group (235.0 36 mg; p<0.001).

26 patients in the insomnia group required a rescue dosage of 1 g paracetamol, compared to 12 individuals in the control group (p=0.001). The mean NRS score was also determined based on the post-operative examination results. 27 participants in the insomnia group (77.1%) and 4 participants in the control group (11.4%) suffered moderate or severe post-operative pain (p<0.001; Table 3).

Table 1: Baseline descriptive and clinical characteristics

	INSOMNIA GROUP	CONTROL GROUP	P
AGE (YEARS)	49.5±9	49.5±9	0.968
GENDER (F/M)	27/8	24/11	0.420
BMI (KG/M²)	28.7 ±4	29.8 ±5	0.286
DURATION OF SURGERY (MINUTE)	45.6±12	49.4 ±12	0.102
PREOPERATIVE PAIN EXPERIENCE (Y/N)	13/22	3/32	0.04
ASA 1/ASA 2	18/17	18/17	1.0

f/m=female/male; BMI=Body mass index; y/n=yes/no; ASA: American Society of Anesthesiologists. Data are presented as mean ±SD and number.

Table 2: Post-operative NRS Scores

	1h	2h	4h	8h	12h	18h
İNSOMNIA GROUP	8.37±2.1	7.43±2.2	6.00±2.1	4.49±1.9	3.09±1.6	2.34±1.6
CONTROL GROUP	7.06±2.3	5.57±2.1	3.29±2.1	1.63±2.0	0.54±1.3	0.43±1.3
P	0.02	<0.001	<0.001	<0.001	<0.001	<0.001

h=hour (Time after operation); Data are presented as mean ±SD

Table 3: Post-operative analgesic consumption and mean NRS scores

	INSOMNIA GROUP	CONTROL GROUP	P
TRAMADOL CONSUMPTION DOSE(MG)*	269.4 ±33	235.0±36	<0.001
RESCUE DOSE OF PARACETAMOL (GR)*	1.06±0.8	0.40±0.7	<0.001
MEAN NRS SCORE ≥4**	27(77.1)	4(11.4)	<0.001

**Data are presented as mean ±SD; ** Data are presented as number (%)*

We performed an analysis of covariance (with the mean NRS score as the dependent variable, insomnia, preoperative experience of pain, and sex as independent variables, and age, BMI, andoperating time as co-variables) to determine the relationship between demographic factors, insomnia, the preoperative experience of pain, and the mean NRS score. We found a significant association between insomnia and preoperative experience of pain ($F=6.62$; $p=0.013$) and a significant impact of insomnia on the mean post-operative NRS score ($F=15.47$; $p<0.001$).

5. DISCUSSION AND CONCLUSION

The results of this case-control study indicate that insomnia affects the initial post-operative experience of pain; 77.1% of our insomniac patients experienced moderate to severe pain microscopic lumbar discectomy. After 1, 2, 4, 8, 12, and 18 hours postoperatively, patients with chronic insomnia reported greater levels of discomfort than the controls.

Pain and sleep have a relationship. Sleep disturbances may exacerbate existing discomfort and predict the onset of future discomfort (Aili, Nyman, Svartengren, & Hillert, 2015; Finan, Goodin, & Smith, 2013; Haack & Mullington, 2005). This intricate connection may be affected by overlapping systems. [(Campbell et al., 2015; Curatolo et al., 2015; Woolf, 2011) Insomnia symptoms may initiate a chain of neurological modifications resulting in central sensitization, which can cause hyperalgesia. Dysfunction of the mesolimbic dopaminergic system may be responsible for the co-occurrence of pain and insomnia. In addition, research has shown that sleep deprivation affects the serotoninergic system, essential for the deteriorating pain inhibitory control system (Blanco-Centurion & Salin-Pascual, 2001; Farooqui, Brock, & Zhou, 1996). The combination of psychological qualities such as anxiety, nervousness, depression, and insomnia may also influence hyperalgesia (Sertdemir & İzci, 2022). Research indicates that instability of the hypothalamic-pituitary-adrenal system plays a crucial role in this complex interplay (Giese et al., 2013; G. E. Miller, Chen, & Zhou, 2007).

Intense pain also serves as a vital indicator of damage to the body's functioning. Acute sleeplessness before surgery has been observed to increase

post-operative pain in rats. Insomnia and acute sleep disturbances differ significantly in their trajectories and histories (Léger, Poursain, Neubauer, & Uchiyama, 2008; Morin et al., 2014). Prior studies revealed that up to 30% of surgical patients experienced pain ratings of >3 on a visual analog scale of 10. The fact that 77.1% of patients in our insomnia group and only 11.4% of patients in the control group experienced moderate to severe post-operative pain demonstrates that the intensity of sleeplessness has a significant effect on acute post-operative pain. Owing to the link between short-acting opioids and pain-related sleep disturbances, adding a background opioid did not improve sleep and was associated with additional adverse effects (George et al., 2010).

Typical post-operative side effects include sleeplessness. High levels of pain, post-operative depressive symptoms, and anxiety, as well as the use of opioids, are the primary factors that contribute to its development. Risk variables are not changed considerably by area sociocultural characteristics (Boduliev & D.A, 2019). Due to the yearly increase in surgical procedures and the significant physiological impact of sleep disorders in the post-operative period, insomnia is vital for contemporary anesthesiology. The most prominent sleep-related concerns among the general population, which extend to elite athletes, are difficulties falling asleep and staying asleep, maintaining sleep, and waking up earlier than anticipated (Morin et al., 2015). Early investigations revealed preoperative pain experience as a predictor of acute postsurgical pain; however, experimental pain assessment studies could not identify patients at risk for acute postsurgical pain (De Cosmo et al., 2008).

Our research indicated a correlation between sleeplessness and preoperative pain but no link between preoperative pain and acute post-operative pain. Sommer et al. observed that preoperative pain was an independent predictor of post-operative pain. We discovered that individuals with sleeplessness experienced higher preoperative pain; as a result, preoperative discomfort was not identified as an independent factor (Sommer et al., 2010). The ISI is a helpful and dependable technique that can be used for purposes other than insomnia condition assessment. Still, it can also be a valuable tool for identifying patients with major insomnia disorder (Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008).

In this manner, we did not just evaluate patients' pain management based on their diagnosis and assessed the degree of insomnia in all individuals. Post-operative pain is still a prevalent concern, and growing evidence indicates a relationship between pain and sleep disturbances. There is a broad consensus that sleep and pain are reciprocal. Reduced sleep habits increase the likelihood of acquiring pain and exacerbate existing pain. There are parallels between the risk factors for developing insomnia and those for experiencing severe post-operative pain. We chose athletes with a history of microscopic lumbar discectomy to limit sleeplessness's potential effects on acute

postsurgical pain in athletes due to variations in operational pathophysiology and techniques.

Implications

The importance of the current work is contingent upon its theoretical implications. This investigation examines the relationships between athletes' POP and sleeplessness. This investigation is a continuation of the past work accomplished by other scholars. Giving more comprehensive perspectives and evaluations strengthens the foundation of previous work on the major topic. To comprehensively analyze the incidence and severity of insomnia among POP athletes, the current research could benefit from incorporating both quantitative and qualitative methods. The study findings would lead to educational initiatives, safeguard athletes from these issues by reducing the stigmas associated with requesting help in sports, and ultimately promote self-guided therapy.

Limitations and Future Directions

While this work contributes greatly to the corpus of knowledge, it does contain limitations that can be addressed in future research. Other surgical patients with insomnia were omitted from the study to ensure homogeneity. Although our study utilized a homogenous sample, its cross-sectional approach poses limitations. Another disadvantage of the study is that it was not conducted under double-blind conditions; only the pain assessor was unaware of the group assignment. Further epidemiological research is required to identify the proportion of surgical patients with post-operative insomnia. Optimize the treatment approach that will provide the best benefit in reducing post-operative insomnia. A combination of pharmacological and non-pharmacological treatment will likely yield the most patient improvement. In addition, if more people are included in this future study, the researchers can present more in-depth analyses and perspectives regarding how sleeplessness influences post-operative pain in sports. The current findings emphasize the importance of sleep for post-operative recovery. The evaluation of sleep quality should be considered while studying surgical outcomes. Consumer-oriented sleep monitors simplify monitoring many sleep parameters before and after surgery. It is easy and quick to administer questionnaires measuring subjective sleep state. Measurements of individual sleep quality reveal information on the participants' emotional states. Sleep enhancement is anticipated to affect mental and physical recovery from post-operative pain positively. Finally, the attitudes of medical professionals should be conducive to promoting restful sleep after surgery. Due to the essential role that sleeps health plays in the training, rehabilitation, achievement, and general well-being of professional athletes, as well as the unique challenges they face that negatively impact their sleep habits and the higher prevalence of sleep issues and disorders among them, there is an obvious need for strategies and interventions that are easy to

implement, specifically tailored to their needs, and effective. The assessment of sleep difficulties and, when necessary, the referral of athletes to a sleep specialist for diagnostic procedures are made feasible by sleep assessment, which has become a significant component of athlete health management. This is a key step, as uncontrolled insomnia will likely render ineffective any sleep-focused approaches. Sadly, irregular, imprecise, and improper research methods are mostly to blame for the poor quality of much of the available study data. This exhaustive analysis and expert perspectives make it abundantly evident that researchers should collaborate and employ better, more reliable research procedures to improve the quality of accessible data and guide doctors appropriately.

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