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Relationship Between Sleep Disturbances and Cognitive Impairment of Schizophrenia

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Abstract: Schizophrenia, cognitive impairments, and sleep disturbances and their effects on each other have been the topics of heavy research in recent years. With the realization of their impacts on each other, More and more studies have been set up to try to find the relationships between the three. The purpose of this article is to go through a few of these studies and clinical cases that focused upon or show traces of evidence of the relationship between sleep, cognitive impairment, and schizophrenia to look for and discuss the correlation and possible causational relationships between sleep disturbance and cognitive impairment in schizophrenia. In total, five studies and one clinical case series will be reviewed in this article to look for the relationship between sleep and schizophrenia. In addition, a discussion focused on the possible explanation of the relationship between sleep and cognitive functions in schizophrenia that are based on this research will be presented to explain the correlation between sleep and cognitive functions of schizophrenic patients.

Keywords: schizophrenia, cognitive impairment, sleep disturbance, mechanism

1. Introduction

Schizophrenia (SC) will affect about 24 million people worldwide by 2022 [1]. Compared to other mental illnesses, such as mania, the concept of schizophrenia is relatively new to the field of psychology. In the 19 century, European psychiatrists started separately recording similar cases of young patients with mental disorders that caused the cognitive and behavioral decline, while the causes of these illnesses were unclear. It was until Emil Kraeplein (1856-1926) intergraded these separate cases into one umbrella diagnosis, dementia praecox, that SC started to appear as a singular illness. Later, the concept of dementia praecox was improved and modified by Eugen Bleuler, which removed the aspect of a terminal state of deterioration and then replaced the name with schizophrenia [2]. In the present day, The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition has classified the symptoms of SC into five domains, hallucinations, disorganized thinking, abnormal motor behavior, and negative symptoms [3]. Patients can be diagnosed as SC when two or more symptoms from the five domains can be observed. In addition, the age of onset for SC is usually from the late teen to the early thirty of adulthood. It is also noticeable that the average age of male patients is much earlier than that of female patients [4].

As SC has been the topic of heavy research for over a century, multiple studies have been established on SC's diagnosis and treatment aspects. Since the pathology of SC is unclear, in order to further the research to find a way to treat the symptoms and understand the illness's mechanism, a

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considerable number of studies of SC were focused on the correlation between brain region changes and cognitive impairment, identifying cognitive behavioral changes, possible treatments for the cognitive impairment, and other factors that can worsen the case. As an example, one of such study has focused on the element of sleep disturbance and how the disruption affects the SC's overall cognitive functioning the next day [5]. Studies like this provided glimpses of how SC affects patients' daily cognitive and behavioral functioning while also providing shreds of evidence and traces of possible treatment and therapy methods to work with to improve the patients' condition of cognitive deficits caused by SC.

Substantial comorbidity between schizophrenia and sleep disorder is common among SC patients [6]. For most of the cases, the sleep disturbances that an SC patient experienced could somewhat predict his/her later SC symptoms onset. Though the relationship between sleep, sleep disturbance, and SC has been hinted at by the accumulated data in the clinical field in recent years, the precise relationship between the three has not been examined due to there being too many other factors that could interfere. In the later paragraph, a few lab studies and clinical-related journals that are focused on sleep, cognitive function, and SC will be presented and summarized to discuss the further correlation between sleep and cognitive impairment of SC.

2. Research in Sleep and Schizophrenia

The first study focused on the impacts of sleep disturbances on the symptoms of SC patients [5]. The data conclude that sleep fragmentation, disturbances during the sleeping process, and poor sleep cycle would increase the hallucination, delusional, and psychotic symptoms of SC patients. In this, they have further indicated the solid correlational relationship between the previous night's sleep cycle and the next day's cognitive functioning of an SC patient.

The second study focused on the effect of high-endurance exercises and their impact on sleep-dependent procedural memory consolidation in SC patients [7]. The data collected in this study showed a positive correlation between exercises and sleep-dependent procedural memory consolidation, in which participants that completed physical exercises during the study showed improvements in their sleep-dependent procedural memory consolidation.

In a similar study to the previous one, this study also focused on exercising and sleep and has shown identical results [8]. The SC participants of the study that have been signed to do physical exercise indeed have improved sleep quality while their symptoms and cognition function have been improved. The research also stated that exercise could possibly be used as an adjunctive treatment in cases of SC to improve cognition and overall sleep. It was also stated in the article that poor sleep quality might contribute to the worsened cognition functioning of SC patients.

The fourth study focused on sleep, problem-solving, and procedural learning in stably medicated schizophrenia patients [9]. The study found that sleep parameters are related to the performance of the problem-solving ability of SC patients.

3. Clinical Studies about Sleep Disorders and Schizophrenia

The first clinical study is a case series [10]. The case series focused on three clinical case reports of SC patients with sleep disorders. The first of three focused on a female long-term SC patient that is in her 30s. The patient has reported poor sleep quality with worsening SC symptoms. As a result of medication and cognitive behavioral therapy, her sleep improved, and her other SC symptoms were relieved. The second of the three cases focused on a ten years SC middle age male patient with sleep apnoeas and daytime sleepiness. In this case, weight gain that came with his treatment was also reported as a side effect of his medication. Due to his medication, he'd gain 30 kg of weight without substantial relief for his symptoms. However, treating his sleep disturbances relieved his daytime

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tiredness and symptoms while also helping his weight loss program. Later, he was no longer admitted to the psychiatry ward and started working again; at the same time, he lost 10 kilograms when checked. The last case of the three focused on a 46-year-old female schizoaffective disorder patient with an SC family history and weight gain that came with the medication. The patient was also diagnosed with obstructive sleep apnoea syndrome during the recorded treatment period. Later, the patient's overall symptoms improved by treating both the SC and sleep disorder symptoms. With a check-up that is six months later, the patient reported stable remission of both sleep and schizoaffective disorder while also losing 12 kilograms of body weight. All scenarios in the case series showed substantial comorbidity between sleep disorders and SC symptoms. While worsening sleep quality in all cases had led to more severe SC symptoms. On the other hand, improving sleep quality has led to the relief of most onset symptoms of SC so that the patient can resume normal daily activities. The connection between improved sleep and the overall condition of SC hinted at a strong link between the sleep process and the cognitive impairments that come with SC.

The second clinical study focused on the effects of eszopiclone on sleep spindle and memory consolidation in schizophrenia [11]. The result of this clinical trial showed improved sleep spindle in SC patients but no improvement in memory. It was stated that in order to improve the quality of sleep, the overall sleeping process should be strengthened instead of just the sleep spindle. The study further explained that other factors, such as cortical slow oscillations, should be enhanced to improve memory consolidation.

4. Discussion

Studies that have been presented above have all shown similar findings and conclusions in related topics of sleep and cognitive functioning of SC patients. All of them have examined and proved the strong correlation between sleep quality and the cognitive impairment symptoms of an SC patient. In contrast, the exact causational relationship between sleep disturbances and SC's cognitive impairment has not been determined and established in these research, and mainly, it is likely due to the small number of samples and cases that can be researched upon. The correlational relationships is also further proven in the recent studies, it has proven that poor sleep is strongly associated with poor cognitive functioning [12]. Another recent article also pointed toward the correlation between sleep and waking cognition, as it stated how sleep and wake cognition can impact each other’s functioning [13]. At this point, it is clear that the sleep quality of SC patients can and will affect their overall cognitive functioning and possibly triggered worsen cognitive symptoms. A possible reason for that could be the sleep-dependent memory consolidation process [7]. More in-depth research could be done in the future to dig deep in the matter. In addition to the clear correlation between sleep and cognition, the possibility of improving the overall sleep quality of an SC patient to relieve his or her cognitive function has been proven feasible and positively working. With previously mentioned case studies that focused on physical exercises to improve sleep and the three case series that all showed weight gain that came as a side effect of medication and sleep apnoea. It is pretty hard not to consider the possible weight gains brought by the SC medication and its impact on how it would severely affect the overall sleep quality of the SC patients and the worsened cognitive functioning and other SC symptoms possibly influenced by the weight gain and decreased sleep quality. Future studies aim to find the relationship between the weight gain caused by SC medication and sleep disorders. At the same time, also find ways to improve SC patients' sleep qualities and look for causes of the comorbid sleep disturbances of the SC patients in order to develop symptom-relieving treatment methods or even recovery methods of SC if the causational relationship between sleep and cognitive impairments of SC is determined. In addition, as suggested by the two studies that focused on exercise and sleep quality improvement of SC patients, future treatment plans and studies can focus on the effect of physical exercise as an adjunct treatment to regular medicinal treatment and counseling.

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5. Conclusions

In conclusion, though the correlation between sleep and SC's cognitive function abnormality is commonly known in the field and researched in recent years, the exact relation between the two still needs to be clarified. It is now known and has been studied that improving sleep quality will improve the life of SC patients by relieving some of the cognitive and overall symptoms of SC. A possible explanation could be the change in the sleep-dependent memory consolidation process that came with improved sleep, which caused the improvement of the cognitive functioning of SC patients. More in-depth studies about the sleep-dependent memory consolidation process in SC can be done in the future to further establish the relationship between sleep-dependent memory consolidation and the Cognitive functioning of SC patients. In addition, it is also important to have those research to establish the exact relationship between sleep disturbance and cognitive impairment, not only so; it will also further the pathology study of SC and possibly develop a more efficient treatment method to improve the life of SC patients. Furthermore, the SC medication's side effects, such as weight changes, should also be considered more carefully in treatments. Such changes in body weight may severely impact the sleep quality of SC patients (as shown in the case series mentioned previously), which would lead to more dire circumstances, such as worsening cognitive impairment symptoms. In future treatment and research of SC-related topics, the relationship between body weight changes and sleep should be considered more, for it can also provide methods and therapy for SC-related sleep disturbances and disorders, which provide more evidence and hints toward the relationship between sleep and SC-related cognitive dysfunction.

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