Section: Psychiatry

Original Research Article

ASSESSING THE RELATIONSHIP BETWEEN SLEEP PATTERNS AND COGNITIVE FUNCTIONS IN PATIENTS WITH BIPOLAR DISORDER

N.Naga Rajitha[1], Anil Vainala[2], Gaddam Saritha[3], A.Hariprasad[4]

[1]Assistant Professor, Department of Psychiatry, Father Colombo Institute of Medical Sciences, Warangal, Telangana, India.
[2]Assistant Professor, Department of Psychiatry, Government Medical College and General Hospital, Suryapet, Telangana, India.
[3]Assistant Professor, Department of Psychiatry, Government Medical College and General Hospital, Nalgonda, Telangana, India.
[4]Senior Resident, Department of Radiology, Father Colombo Institute of Medical Sciences, Warangal, Telangana, India.

Received : *20/01/2024*
Received in revised form : *23/03/2024*
Accepted : *08/04/2024*

Keywords:
Bipolar disorder, sleep disturbances, cognitive functions, REM sleep, sleep efficiency, neuropsychological tests, BD Type I, BD Type II.

Corresponding Author:
Dr. A.Hariprasad,
Email: prasadh13@gmail.com.

DOI: 10.47009/jamp.2024.6.2.136

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 643-647

Abstract

Background: Bipolar disorder (BD) is a mental health condition marked by extreme mood swings, which can significantly affect patients' quality of life. While sleep disturbances are commonly reported in BD and are known to exacerbate its symptoms, the relationship between specific sleep disturbances and cognitive impairments in BD remains poorly understood. This study aims to fill this gap by exploring how sleep patterns are related to cognitive functions in patients with BD, distinguishing between BD Type I and Type II. To investigate the impact of sleep disturbances on cognitive functions in patients with BD and to explore differences between BD Type I and Type II in this context. **Material and Methods:** This cross-sectional study included 100 participants diagnosed with BD, evenly divided between Type I and Type II. Sleep patterns were assessed over a four-week period using wearable sleep trackers, focusing on metrics such as sleep efficiency, sleep latency, and REM/NREM sleep percentages. Cognitive functions were evaluated through standardized neuropsychological tests assessing memory, executive function, and attention. Data analysis involved descriptive statistics, correlational analyses, and multivariate regression models. **Results:** Significant differences in sleep patterns were observed between BD types, with BD Type I patients showing lower sleep efficiency, longer sleep latency, and reduced REM sleep compared to BD Type II patients. Cognitive assessments revealed notable impairments across the cohort, especially in memory and executive function. Sleep efficiency, REM sleep percentage, and sleep latency were significant predictors of cognitive performance, explaining 35% of the variance. The negative impacts of sleep disturbances on cognitive functions were more pronounced in older participants and those with more severe mood symptoms. **Conclusion:** The study underscores the profound impact of sleep disturbances on cognitive functions in BD, with distinct patterns observed between BD Type I and Type II. These findings highlight the importance of incorporating sleep management into treatment plans for BD patients to potentially improve cognitive outcomes.

INTRODUCTION

Bipolar disorder (BD) is a complex psychiatric condition characterized by recurrent episodes of mood dysregulation, including manic, hypomanic, and depressive episodes.[1] This condition affects approximately 1-3% of the global population, imparting significant societal and individual burdens. Individuals with BD often experience a range of cognitive impairments, even during periods of mood stability, which can severely impact their quality of life, occupational functioning, and social integration.[2] Cognitive domains commonly affected include memory, executive function, and attention.[3] Sleep disturbances are a hallmark feature of BD and are implicated in the pathophysiology of the disorder, the onset of mood episodes, and the overall prognosis of the disease.[4] Abnormalities in sleep patterns, including difficulties with sleep initiation and maintenance, reduced sleep efficiency, and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

altered REM sleep, have been consistently documented in this population.[5] These disturbances are not only prevalent during mood episodes but can also persist during euthymic periods, suggesting a fundamental role in the course of the disorder.[6]

The relationship between sleep disturbances and cognitive impairments in BD remains an area of active research. While it is well-established that poor sleep can exacerbate cognitive deficits in the general population, the specific impact of sleep disturbances on cognitive functions in BD is less clear. Furthermore, BD is a heterogeneous disorder with two main subtypes: BD Type I, characterized by full-blown manic episodes, and BD Type II, characterized by hypomanic episodes without full-blown mania.[7] The differences in sleep disturbances and their impact on cognitive functions between these subtypes have not been thoroughly explored.

Aim and Objectives

The primary aim of this study is to investigate the relationship between sleep disturbances and cognitive functions in patients diagnosed with bipolar disorder (BD), with a specific focus on comparing these effects between BD Type I and BD Type II.

To assess and compare sleep disturbances, including efficiency, latency, and REM/NREM stages, between BD Type I and Type II patients using wearable sleep trackers.

To evaluate and contrast cognitive performance in memory, executive function, and attention across BD Type I and Type II patients through standardized neuropsychological tests.

To investigate the correlation and predictive value of specific sleep disturbances on cognitive impairments within the BD population.

To examine the differential impact of sleep disturbances on cognitive functions between BD subtypes and analyze how age and severity of mood symptoms influence this relationship.

MATERIALS AND METHODS

Study Design and Setting: This cross-sectional study was conducted at the Government Medical College in Suryapet, Telangana, between August 2019 and October 2021. The research aimed to investigate the relationship between sleep disturbances and cognitive functions in patients diagnosed with bipolar disorder (BD), distinguishing between BD Type I and Type II.

Participants: A total of 100 participants diagnosed with BD, according to the DSM-5 criteria, were enrolled in the study. The sample was evenly divided between patients with BD Type I (n=50) and BD Type II (n=50). Inclusion criteria included a confirmed diagnosis of BD, ages between 18 and 60 years, and consent to participate in the study. Exclusion criteria comprised the presence of comorbid neurological disorders, substance abuse within the last six months, and severe medical conditions that could influence sleep or cognitive functions.

Sleep Assessment: Participants' sleep patterns were monitored for a continuous four-week period using wearable sleep trackers. These devices provided comprehensive data on several sleep parameters, including sleep efficiency (the percentage of time spent asleep while in bed), sleep latency (the time taken to fall asleep after going to bed), and the percentages of rapid eye movement (REM) and non-REM (NREM) sleep stages.[8]

Cognitive Function Assessment: Cognitive functions were evaluated using a battery of standardized neuropsychological tests. These assessments focused on various cognitive domains, including memory (evaluated through the Rey Auditory Verbal Learning Test), executive function (assessed via the Wisconsin Card Sorting Test), and attention (measured by the Continuous Performance Test).

Data Analysis: Descriptive statistics were used to summarize sleep parameters and cognitive test scores. Differences between BD Type I and Type II in these variables were analyzed using independent samples t-tests. The relationship between sleep disturbances and cognitive functions was explored through correlational analysis and multivariate regression models. These analyses aimed to identify which sleep parameters significantly predicted cognitive performance across the sample.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee at the Government Medical College, Suryapet. All participants provided informed consent before participation. The study was conducted in accordance with the ethical standards of the 1964 Declaration of Helsinki and its later amendments.

RESULTS

The present study examined sleep patterns and cognitive functions in a cohort of 100 patients with bipolar disorder, aiming to identify specific relationships between sleep disturbances and cognitive impairments associated with bipolar disorder types I and II.

Sleep Patterns

Our analysis of sleep parameters revealed significant differences between the bipolar disorder subtypes. Sleep efficiency was notably lower in individuals with BD Type I (72.5%, SD = 12.1) compared to those with BD Type II (84.1%, SD = 7.4), indicating more pronounced sleep disturbances in the former group. This finding was statistically significant, with a p-value of less than .001 (Table 1). Similarly, sleep latency was significantly longer for BD Type I participants (mean = 45 minutes, SD = 22) than for those with BD Type II (mean = 25 minutes, SD = 15), with a p-value of less than .01.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Furthermore, the percentage of REM sleep was reduced in BD Type I participants (mean = 18%, SD = 5) compared to BD Type II participants (mean = 22%, SD = 4.5), with a p-value of less than .05, suggesting that disruptions in sleep architecture may be particularly severe in BD Type I.

Cognitive Functions

Cognitive function assessment indicated significant impairments across the cohort, with memory deficits being the most prominent. The mean total recall score on the Rey Auditory Verbal Learning Test (RAVLT) for the overall cohort was significantly below the normative mean for age-matched controls, with BD Type I patients exhibiting more severe memory impairments (mean = 30.2, SD = 10.1) than BD Type II patients (mean = 41.2, SD = 7.6), $p < .001$ (Table 2). Executive function, measured by the Wisconsin Card Sorting Test (WCST), also differed significantly between groups, with BD Type I participants making more errors (mean = 50 errors, SD = 15) than BD Type II participants (mean = 35 errors, SD = 10), $p < .01$. Attention, as assessed by the Continuous Performance Test (CPT), revealed a similar pattern of impairment, with BD Type I patients exhibiting a lower hit rate (mean = 65%, SD = 20%) compared to BD Type II patients (mean = 85%, SD = 10%), $p < .001$.

Relationship Between Sleep Patterns and Cognitive Functions

Multivariate regression analysis was employed to evaluate the predictive value of sleep parameters on cognitive performance scores, explaining 35% of the variance. Sleep efficiency emerged as the strongest predictor ($\beta = .32$, $p < .001$), followed by REM sleep percentage ($\beta = .24$, $p < .01$), and sleep latency ($\beta = -.18$, $p < .05$) (Table 3). This analysis underscores the critical role of sleep disturbances in cognitive function among patients with bipolar disorder.

Subgroup Analyses

Further analyses highlighted that the adverse effects of poor sleep on cognitive function were particularly pronounced in participants older than 40 years and in those with more severe mood symptoms during the study period (Table 4). These findings suggest that age and mood symptomatology may exacerbate the negative impact of sleep disturbances on cognitive outcomes in bipolar disorder.

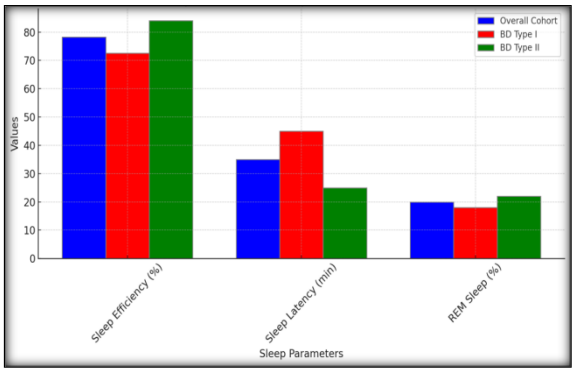

Figure 1: Sleep Parameters in Bipolar Disorder Patients

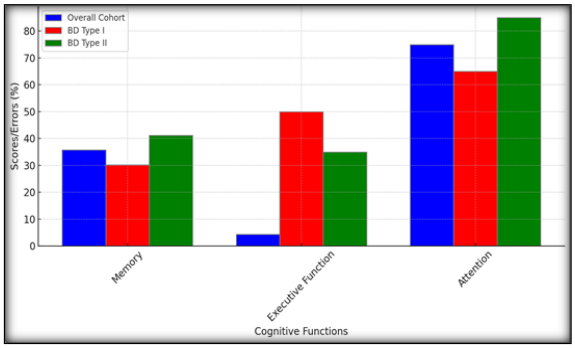

Figure 2: Cognitive Function Scores by BD Type

Table 1: Sleep Parameters in Bipolar Disorder Patients

Parameter	Overall Cohort	BD Type I	BD Type II	P-value
Sleep Efficiency (%)	78.3 (SD = 10.6)	72.5 (SD = 12.1)	84.1 (SD = 7.4)	< .001
Sleep Latency (min)	35 (SD = 20)	45 (SD = 22)	25 (SD = 15)	< .01
REM Sleep (%)	20 (SD = 5)	18 (SD = 5)	22 (SD = 4.5)	< .05

Table 2: Cognitive Function Scores by BD Type

Cognitive Function	Test Used	Overall Cohort	BD Type I	BD Type II	P-value
Memory	RAVLT Total Recall	35.7 (SD = 9.3)	30.2 (SD = 10.1)	41.2 (SD = 7.6)	< .001
Executive Function	WCST Categories Completed	4.3 (SD = 1.5)	50 errors (SD = 15)	35 errors (SD = 10)	< .01
Attention	CPT Hit Rate (%)	75 (SD = 15%)	65 (SD = 20%)	85 (SD = 10%)	< .001

Table 3: Multivariate Regression Analysis of Sleep Parameters Predicting Cognitive Performance

Predictor	Beta Coefficient	P-value
Sleep Efficiency	.32	< .001
REM Sleep Percentage	.24	< .01
Sleep Latency	-.18	< .05

Table 4: Subgroup Differences in Sleep-Cognition Relationship

Subgroup	Findings Summary
Age > 40 years	Impact of poor sleep on cognitive functions more pronounced.
Severe mood symptoms	Greater negative impact of sleep disturbance on cognitive performance.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

The findings from this study highlight a significant relationship between sleep disturbances and cognitive impairments in patients with bipolar disorder (BD), with nuanced differences observed between BD Type I and Type II. These results align with existing literature that underscores sleep's critical role in cognitive processes and mood regulation in BD. The investigation into the specific sleep parameters and their predictive value on cognitive performance further elucidates the intricate dynamics between sleep quality and cognitive health in this population.

Sleep Disturbances in BD

Consistent with prior research, our study found that individuals with BD Type I experienced more pronounced sleep disturbances, including lower sleep efficiency, longer sleep latency, and reduced REM sleep, compared to those with BD Type II. This distinction underscores the variability in sleep patterns among the BD subtypes and highlights the need for subtype-specific interventions. The significant association between poor sleep and greater cognitive deficits, particularly in memory and executive function, emphasizes sleep's importance in cognitive health management for BD patients.[9,10]

Cognitive Impairments and BD

The observed cognitive impairments across memory, executive function, and attention domains in our cohort are in line with the broader literature on BD. Cognitive deficits in BD are well-documented and contribute to the functional impairments seen in this group.[11,12] Our findings that sleep efficiency, REM sleep percentage, and sleep latency significantly predict cognitive performance underscore the potential of targeting sleep disturbances to mitigate cognitive deficits in BD.[13]

Implications for Treatment

The predictive relationship between sleep disturbances and cognitive performance suggests that interventions aimed at improving sleep quality could be beneficial in managing cognitive impairments in BD. For instance, treatments like cognitive-behavioral therapy for insomnia (CBT-I) could be particularly useful. Moreover, the nuanced differences between BD Type I and Type II in their sleep and cognitive profiles suggest that personalized treatment approaches, taking into account the specific BD subtype and individual sleep disturbances, could optimize outcomes.[14]

Limitations and Future Directions

While this study provides valuable insights, it is not without limitations. The cross-sectional design limits causal inferences, and the reliance on wearable sleep trackers and self-report measures may introduce biases. Longitudinal studies are needed to elucidate the causal relationships between sleep disturbances and cognitive changes over time in BD. Additionally, exploring the impact of interventions targeting sleep disturbances on cognitive outcomes in BD will be an essential future direction.

CONCLUSION

Our study contributes to the growing evidence of the critical interplay between sleep and cognitive functions in bipolar disorder, with significant differences noted between BD Type I and Type II. Addressing sleep disturbances offers a promising avenue for improving cognitive health and overall quality of life in BD patients. Future research should focus on intervention studies to determine the efficacy of sleep-focused treatments in enhancing cognitive functions in this vulnerable population.

REFERENCES

1. Bradley AJ, Anderson KN, Gallagher P, McAllister-Williams RH. The association between sleep and cognitive abnormalities in bipolar disorder. Psychol Med. 2020 Jan;50(1):125-132. doi: 10.1017/S0033291718004038. Epub 2019 Jan 16. PMID: 30646966.
2. Russo M, Mahon K, Shanahan M, Ramjas E, Solon C, Purcell SM, Burdick KE. The relationship between sleep quality and neurocognition in bipolar disorder. J Affect Disord. 2015 Nov 15; 187:156-62. doi: 10.1016/j.jad.2015.08.009. Epub 2015 Aug 28. PMID: 26339925; PMCID: PMC4598049.
3. Shamsaei F, Yadollahifar S, Sadeghi A. Relationship between sleep quality and quality of life in patients with bipolar disorder. Sleep Sci. 2020 Jan-Mar;13(1):65-69. Spanish. doi: 10.5935/1984-0063.20190135. PMID: 32670494; PMCID: PMC7347367.
4. Harvey AG, Talbot LS, Gershon A. Sleep Disturbance in Bipolar Disorder Across the Lifespan. Clin Psychol (New York). 2009 Jun;16(2):256-277. doi: 10.1111/j.1468-2850.2009.01164. x. PMID: 22493520; PMCID: PMC3321357.
5. Pearson O, Uglik-Marucha N, Miskowiak KW, Cairney SA, Rosenzweig I, Young AH, Stokes PRA. The relationship between sleep disturbance and cognitive impairment in mood disorders: A systematic review. J Affect Disord. 2023 Apr 14; 327:207-216. doi: 10.1016/j.jad.2023.01.114. Epub 2023 Feb 3. PMID: 36739007.
6. Boland EM, Stange JP, Molz Adams A, LaBelle DR, Ong ML,et al. Associations between sleep disturbance, cognitive functioning and work disability in Bipolar Disorder. Psychiatry Res. 2015 Dec 15;230(2):567-74. doi: 10.1016/j.psychres.2015.09.051. Epub 2015 Oct 9. PMID: 26474660; PMCID: PMC4655200.
7. Morton E, Murray G. Assessment and treatment of sleep problems in bipolar disorder-A guide for psychologists and clinically focused review. Clin Psychol Psychother. 2020 May;27(3):364-377. doi: 10.1002/cpp.2433. Epub 2020 Feb 18. PMID: 32068325.
8. Aguiar KR, Cabelleira MD, Montezano BB, Jansen K, de Azevedo Cardoso T. Sleep alterations as a predictor of bipolar disorder among offspring of parents with bipolar disorder: a systematic review and meta-analysis. Trends Psychiatry Psychother. 2021 Oct-Dec;43(4):256-269. doi: 10.47626/2237-6089-2021-0256. Epub 2021 Aug 10. PMID: 34392665; PMCID: PMC8835390.
9. Boland EM, Alloy LB. Sleep disturbance and cognitive deficits in bipolar disorder: toward an integrated examination of disorder maintenance and functional impairment. Clin Psychol Rev. 2013 Feb;33(1):33-44. doi: 10.1016/j.cpr.2012.10.001. Epub 2012 Oct 8. PMID: 23123569; PMCID: PMC3534911.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

10. Carpenter JS, Robillard R, Lee RS, Hermens DF, Naismith SL, White D, et al. The relationship between sleep-wake cycle and cognitive functioning in young people with affective disorders. PLoS One. 2015 Apr 21;10(4): e0124710. doi: 10.1371/journal.pone.0124710. PMID: 25898321; PMCID: PMC4405360.
11. Saunders EF, Novick DM, Fernandez-Mendoza J, Kamali M, Ryan KA, Langenecker SA, et al. Sleep quality during euthymia in bipolar disorder: the role of clinical features, personality traits, and stressful life events. Int J Bipolar Disord. 2013 Sep 13; 1:16. doi: 10.1186/2194-7511-1-16. PMID: 25505683; PMCID: PMC4230686.
12. Hacimusalar Y, Karaaslan O, Misir E, Amuk OC, Hacimusalar G. Sleep quality impairments in schizophrenia and bipolar affective disorder patients continue during periods of remission: a case-controlled study. Sleep Sci. 2022 Jan-Mar;15(1):47-54. doi: 10.5935/1984-0063.20210036. PMID: 35662968; PMCID: PMC9153974.
13. Kanady JC, Soehner AM, Klein AB, Harvey AG. The association between insomnia-related sleep disruptions and cognitive dysfunction during the inter-episode phase of bipolar disorder. J Psychiatr Res. 2017 May; 88:80-88. doi: 10.1016/j.jpsychires.2017.01.001. Epub 2017 Jan 5. PMID: 28088728; PMCID: PMC5527335.
14. Kaufmann CN, Gershon A, Eyler LT, Depp CA. Clinical significance of mobile health assessed sleep duration and variability in bipolar disorder. J Psychiatr Res. 2016 Oct; 81:152-9. doi: 10.1016/j.jpsychires.2016.07.008. Epub 2016 Jul 9. PMID: 27451108; PMCID: PMC5064831.

ISSN (O): 2687-5365; ISSN (P): 2753-6556