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Original Research Article

Exploring the long-term impact of COVID-19: incidence and factors associated with insomnia in recovered patients

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ABSTRACT

Background: COVID-19's recognition as a multi-organ disease with diverse manifestations extends beyond acute illness into post-recovery phases. Post-COVID-19 infection, individuals often endure a spectrum of psychiatric symptoms, notably including persistent insomnia. This study aimed to investigate insomnia's correlation with age, gender, comorbidity, infection severity, and biomarkers during hospitalization.
Methods: This study employed a prospective design to explore the correlation between insomnia and various factors in COVID-19 survivors. Data were collected over a one-year period, with an emphasis on age, gender, comorbidity, infection severity, and biomarkers.
Results: The incidence of insomnia among patients was approximately 7%. Notably, no significant statistical correlation emerged between insomnia and COVID-19 infection severity. Furthermore, insomnia prevalence remained unaffected by demographic factors such as gender, age, or comorbidity.
Conclusions: The lasting impact of COVID-19 on mental health, particularly in terms of persistent insomnia, underscores the necessity for targeted interventions. Identifying factors contributing to insomnia among survivors holds paramount importance for developing effective management strategies that bolster overall well-being and quality of life. Recognizing and addressing insomnia as a significant long-term consequence of COVID-19 becomes imperative, as implementing appropriate interventions and support services can mitigate detrimental effects on mental and physical health. Ultimately, this contributes to improved outcomes and an enhanced quality of life for survivors.

Keywords: COVID-19, Insomnia, Post-COVID syndrome

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has led to the coronavirus disease (COVID-19) pandemic, resulting in precedented loss and suffering worldwide.[1] It is now recognized that COVID - 19 is a multi-organ disease presenting with a broad spectrum of manifestations, both during the illness and after recovery.[2] Post-acute COVID-19 syndrome refers to persistent symptoms and/or delayed complications that can occur even after 4 weeks from the onset of symptoms.[3] Among the various systemic manifestations following COVID-19 infection, individuals often experience a wide range of psychiatric symptoms that persist or emerge months after the initial infection.[4]

Insomnia, characterized by an individual's report of difficulty with sleep, is one such symptom.[5] In the sleep literature, insomnia is defined as the presence of polysomnographic evidence of disturbed sleep. This may include frequent nocturnal awakenings, prolonged sleep latency, frequent transient arousals, or extended periods of wakefulness during the sleep period.[5] Numerous studies have shown that individuals with insomnia report decreased quality of life across multiple dimensions, as

assessed by the 36-item short form health survey of the medical outcomes study (SF-36).[6]

These dimensions include physical functioning, bodily pain, role limitations due to emotional and physical health problems, general health perceptions, vitality, social functioning, and mental health.[7] Insomnia poses significant challenges to public health, as it is associated with marked impairment in function, reduced quality of life, and increased risk of accidents, as well as psychiatric and physical morbidity.[8] Sleep is crucial for overall health and well-being, particularly for individuals recovering from a critical illness who are in a physiologically vulnerable state.[9] COVID-19 has presented unique challenges due to the physical distress of the illness and prolonged measures of social confinement and isolation, leading to significant psychological distress.[10] Chronic insomniacs are more susceptible to pain disorders and gastrointestinal issues, and are at risk for hypertension and heart diseases if left untreated.[11]

Prolonged sleep deprivation can also lead to increased levels of pro-inflammatory cytokines, inducing a state of mild inflammation and decreasing immunity.[12] These manifestations contribute to a decrease in quality of life and delayed recovery, underscoring the importance of appropriate diagnosis and management of insomnia.[13] Our study aims to investigate the incidence of insomnia in COVID-19 patients after recovery and determine its correlation with age, gender, comorbidity, biomarkers, and infection severity.

METHODS

Study design

This study employed a prospective cohort design to assess the incidence of insomnia and its correlation with various factors in COVID-19 patients after recovery.

Source of data

The study was conducted using data obtained from patients admitted to the COVID-19 wards of Vydehi Institute of Medical Sciences and Research Centre, Bangalore.

Sample size

A total of 118 patients were included in the study.

Duration of study

The study was conducted from May-2021 to May-2022 (12 months).

Inclusion criteria

Age above 18 years, and patients diagnosed with COVID-19 (confirmed by RT-PCR or rapid antigen test) who were discharged from the hospital were included.

Exclusion criteria

Patients with a history of obstructive sleep apnea (OSA), patients with a history of cardiac failure, and patients with known sleep abnormalities were excluded.

Data extraction and quality assessment

After discharge from the hospital, follow-up of patients who had recovered from COVID-19 was conducted via telephonic communication. One month after discharge, the study objectives were explained, and patients were sent Google Forms via WhatsApp. The Google Forms included a consent form and a proforma that included the Insomnia Severity Index, a validated questionnaire, used to assess the severity of insomnia. This data was used to assess the incidence and severity of insomnia.

Follow-up assessments were also conducted at 3rd, 6th and 12 months after discharge using telephonic communication. In addition, data regarding inflammatory markers during the hospital stay were obtained from patient files and recorded in the proforma to assess the severity of infection.

Statistical analysis

The data obtained from hospital records and telephonic follow-up assessments were analyzed using appropriate statistical methods. Correlations between insomnia and factors such as age, gender, comorbidity, severity of infection, and biomarkers during the hospital stay were examined.

Ethical considerations

Informed consent was obtained from all participants before their inclusion in the study. Patient confidentiality was maintained throughout the study.

RESULTS

The mean age of the sample population was 47.18 years, with 51.7% of them being female. Among the sample patients, the prevalence of comorbidities was as follows: diabetes mellitus (7.6%), hypertension (2.5%), hypothyroidism (2.5%), anaemia (0.8%), asthma (1.7%), and ischemic heart disease (0.8%) (Table 1). In terms of COVID-19 infection severity, 33.9% had mild, 54.2% had moderate, and 11.9% had severe infection.

During the 12-month study period, insomnia was present in 16.9% of the sample size at some point (Table 2). The incidence of insomnia decreased over time, with 16.1% after the 1st month, 10.2% after the 3rd month, 6.8% after the 5th month, and 6.8% after the 12th month following discharge. The incidence of insomnia during the 5th and 12th months can be directly attributed to COVID-19 infection (Table 6). However, there was no statistically significant correlation between age, gender, and

comorbidity with the incidence of insomnia, with p values of 0.62, 0.51, and 0.63, respectively (Table 3).

Using the Kruskal-Wallis test followed by Mann-Whitney Post hoc test, correlations between biomarkers and the severity of COVID-19 infection were assessed. The results showed statistically significant correlations ($p<0.05$) between C-reactive protein (CRP), D-dimer, lactate dehydrogenase (LDH), and Ferritin levels with the severity of COVID-19 illness (Table 4). Specifically, mean CRP levels showed significant correlations in mild and moderate cases of COVID-19 ($p=0.003$) and in mild and severe cases ($p=0.001$), while there was no significant correlation between moderate and severe cases ($p=0.12$). Similar patterns were observed for mean D-dimer, LDH, and ferritin levels.

However, there was no significant correlation between the severity of COVID-19 infection and the incidence of insomnia, with a p value of 0.86 (Table 5).

Within the sample size of 118 patients followed up for one year, the overall incidence of insomnia was approximately 7% among those admitted to the hospital. Biomarkers were used to assess the severity of COVID-19 infection, and a positive trend in insomnia was observed from mild to severe cases.

However, statistical analysis revealed no significant correlation between the incidence of insomnia and the severity of COVID-19 infection. These findings suggest that while insomnia may be more prevalent in individuals with more severe COVID-19, biomarkers cannot be relied upon to predict the occurrence of insomnia. Furthermore, the incidence of insomnia was found to be independent of gender, age, and comorbidity.

Table 1: Distribution of study patients based on presence of different comorbidity condition.

Comorbidities	n	%
Diabetes mellitus	9	7.6
Hypertension	3	2.5
Hypothyroidism	3	2.5
Anemia	1	0.8
Asthma	2	1.7
IHD	1	0.8
Nil	104	88.1

Table 2: Distribution of insomnia among COVID-19 patients at different time intervals.

Time	n	%
Month 1		
Present	19	16.1
Absent	99	83.9
Month 3		
Present	12	10.2
Absent	106	89.8
Month 6		
Present	8	6.8
Absent	110	93.2
Year 1		
Present	8	6.8
Absent	110	93.2

Table 3: Comparison of incidence of insomnia based on age, gender and comorbidities using Chi square test.

Variables	Present		Absent		P value
	N	%	N	%	
Age (years)					
≤20	0	0.0	3	100.0	0.62
21-40	7	18.9	30	81.1	
41-60	11	19.3	46	80.7	
>60	2	9.5	19	90.5	
Gender					
Males	11	19.3	46	80.7	0.51
Females	9	14.8	52	85.2	
Comorbidity					
Present	3	21.4	11	78.6	0.63
Absent	17	16.3	87	83.7	

Table 4: Comparison of mean values of different parameters based on the severity of COVID-19 using Kruskal Wallis test followed by Mann Whitney post hoc test.

Parameters	COVID	N	Mean	SD	Min	Max	P value[a]	Sig. dif	P value[b]
CRP (mg/dl)	Mild	40	2.635	3.348	0.02	12.00	0.001*	Mi vs Mo	0.003*
	Moderate	64	5.017	5.102	0.15	24.00		Mi vs Se	0.001*
	Severe	14	13.177	19.408	0.43	72.54		Mo vs Se	0.12
D-Dimer	Mild	40	284.05	122.90	162.0	848.9	<0.001*	Mi vs Mo	<0.001*

Continued.

Parameters	COVID	N	Mean	SD	Min	Max	P value[a]	Sig. dif	P value[b]
(ng/ml)	Moderate	64	528.66	715.63	188.0	5057.0		Mi vs Se	<0.001*
	Severe	14	533.98	486.47	255.0	2159.0		Mo vs Se	0.27
LDH (U/L)	Mild	40	208.93	74.55	105.0	486.0		Mi vs Mo	<0.001*
	Moderate	64	291.19	154.22	126.0	1257.0	<0.001*	Mi vs Se	<0.001*
	Severe	14	380.07	111.86	197.0	578.0		Mo vs Se	0.004*
Ferritin (ng/ml)	Mild	40	186.32	237.23	4.0	1027.9		Mi vs Mo	0.001*
	Moderate	64	366.81	370.37	11.7	1600.0	<0.001*	Mi vs Se	0.002*
	Severe	14	480.86	406.77	42.7	1500.0		Mo vs Se	0.26

*Statistically significant, a – p value derived by Kruskal Wallis test, b – p value derived by Mann Whitney post hoc test

Table 5: Comparison of incidence of insomnia based on the severity of COVID-19 using Chi square test.

Variables	Present		Absent		P value
	n	%	n	%	
Mild	6	15.0	34	85.0	
Moderate	11	17.2	53	82.8	0.86
Severity	3	21.4	11	78.6	

DISCUSSION

The significant correlations between specific biomarkers and the severity of COVID-19 infection, as uncovered in this study, provide valuable insights into the underlying pathophysiology of the disease. It highlights the intricate interplay between inflammatory markers and the progression of COVID-19.[14] Understanding these mechanisms is pivotal in identifying potential therapeutic targets and designing more tailored treatment approaches.

The study also emphasizes on the enduring impact of COVID-19 on mental health, particularly in relation to persistent insomnia.[15] It further contributes by identifying the independence of insomnia incidence from demographic factors, thereby emphasizing the need for holistic approaches to address the multifaceted nature of post-COVID-19 psychiatric symptoms.

Moreover, continued research is imperative to elucidate the complex relationship between specific biomarkers, insomnia, and the diverse clinical presentations of COVID-19. By integrating these findings into clinical practice, healthcare professionals can offer comprehensive and personalized care for COVID-19 survivors.

Strategies may involve the implementation of tailored cognitive behavioral therapies, informed by the interplay between biomarkers and psychiatric symptoms, to mitigate the negative impact of insomnia on overall well-being. The holistic management of post-COVID-19 sequelae, considering both physiological and psychological aspects, is crucial for promoting successful recovery and enhancing the quality of life for individuals affected by the disease.

Limitations

Several limitations should be acknowledged in this study. First, the sample size of 118 patients may limit the generalizability of the findings to a larger population. The study was conducted at a single tertiary care center, which could introduce selection bias and restrict the representation of diverse patient populations. Additionally, the reliance on self-reported data via telephonic communication for assessing insomnia and follow-up may introduce recall bias and subjective interpretation of symptoms. Moreover, the 12-month duration of the study might not capture long-term changes in insomnia prevalence and severity. Furthermore, while the study explored the correlation between insomnia and biomarkers, the causality between these factors cannot be determined due to the study's observational nature. Despite these limitations, this study provides valuable insights into the incidence and correlation of insomnia in COVID-19 survivors, laying the foundation for future research to overcome these limitations and expand our understanding of this important aspect of post-COVID-19 care.

CONCLUSION

In conclusion, our study highlights the enduring impact of COVID-19 on mental health, particularly emphasizing insomnia as a significant long-term consequence independent of demographic factors and infection severity. The significant correlations observed between specific biomarkers and COVID-19 severity provide valuable insights into the disease's underlying pathophysiology, offering potential directions for future research and targeted therapeutic interventions. By contributing to the growing body of evidence on the complex interplay between COVID-19, insomnia, and associated biomarkers, our study underscores the importance of holistic approaches to post-COVID-19 care. These findings provide a crucial foundation for healthcare professionals to develop comprehensive management strategies that integrate both physiological and psychological considerations, ultimately improving the quality of life and well-being of COVID-19 survivors. As the global community continues to grapple with the repercussions of

the pandemic, our study serves to guide future research efforts and clinical practices, facilitating more effective and personalized care for those affected by COVID-19 and its long-term consequences.

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