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Original Article

Prevalence of Hyperventilation Syndrome among Covid-19 Recovered Patients

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ABSTRACT

Background: Coronavirus causes respiratory impairment in humans. In the post-acute care of COVID-19 survivors, persistent cardiorespiratory problems, such as tachycardia, dyspnea, muscle weakness, exercise intolerance, and hypocapnia due to Hyperventilation Syndrome (HVS), have been reported. Other symptoms include depression, anxiety, arthralgia, headache, and palpitations.

Objective: The objective of this study was to determine the prevalence of Hyperventilation Syndrome among COVID-19 recovered patients.

Methods: This cross-sectional descriptive study was conducted using a sample size of 377 participants, calculated via Raosoft. Non-probability convenience sampling was employed. Data were collected using the Nijmegen Questionnaire (NQ) and a demographic form. Participants were recruited through social media platforms and the University of South Asia (Lahore Cantt). Eligible participants were aged 17-60 years, both male and female, who had tested positive for COVID-19 and recovered. Exclusion criteria included any history of respiratory complaints such as asthma, chronic obstructive pulmonary disease, pneumonia, and chronic bronchitis. Data analysis was performed using SPSS version 25.

Results: Out of 377 participants, 148 (39.26%) were male and 229 (60.74%) were female. The mean age was 29.92 years (SD = 9.734). Among the participants, 240 (63.66%) were found to have Hyperventilation Syndrome, while 137 (36.34%) did not exhibit HVS. The most frequently reported symptoms included feeling of anxiety (41.91%), palpitations (20.95%), feeling of confusion (13.26%), feeling tense (11.41%), dizzy spells (10.88%), and blurred vision (37.93%).

Conclusion: Hyperventilation Syndrome is a significant post-COVID-19 complication that affects a substantial proportion of recovered patients, leading to breathing impairments and affecting their quality of life. The study highlights the need for continued monitoring and targeted interventions for managing respiratory symptoms in COVID-19 survivors.

Keywords: Hyperventilation Syndrome, COVID-19 recovery, post-acute complications, respiratory symptoms.

INTRODUCTION

Hyperventilation Syndrome (HVS) is a respiratory disorder characterized by rapid and deep breathing that disrupts the balance of oxygen and carbon dioxide in the body. This imbalance leads to a reduction in carbon dioxide levels, causing vasoconstriction of blood vessels that supply the brain, resulting in various symptoms such as dizziness, tingling in the fingers, and, in severe cases, syncope (1). The COVID-19 pandemic has introduced new challenges in post-acute care, with survivors often experiencing prolonged cardiorespiratory issues. Persistent symptoms such as dyspnea, muscle weakness, exercise intolerance, and hypocapnia due to HVS have been reported, highlighting the need for further investigation into these post-COVID-19 complications (2).

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In patients who have recovered from COVID-19, the infection can lead to an imbalance in ventilatory control systems, resulting in hyperventilation. This can be due to increased activity of control systems in the brain or decreased activity of inhibitory systems. The resultant hypocapnia can cause a range of severe symptoms during physical activity, including dyspnea, tachycardia, chest pain, fatigue, disorientation, and syncope (3). The condition, termed respiratory alkalosis, occurs when the body's pH rises due to decreased carbon dioxide levels, leading to symptoms such as lightheadedness, numbness, and carpopedal spasms (3). Various factors, including physiological stress, anxiety, high altitude, heat stroke, and cardiovascular issues, can precipitate hyperventilation (3).

Recent studies have focused on the prevalence of HVS among COVID-19 survivors. For instance, Justina et al. (2021) observed a significant incidence of hyperventilation with persistent cardiorespiratory symptoms several months post-COVID-19 recovery (4). Another study by Taverne et al. (2021) reported a high prevalence of HVS and inspiratory dyspnea in COVID-19 survivors (5). Benoit Bouteleux et al. (2021) found that respiratory rehabilitation could address persistent dyspnea related to HVS in post-COVID-19 patients (6). Similar findings were reported by Ernesto et al. (2021), who associated residual lung function impairment with hyperventilation in recovered COVID-19 patients (7-9).

The aim of our study was to determine the prevalence of HVS among COVID-19 recovered patients. We conducted a cross-sectional descriptive study using the Nijmegen Questionnaire (NQ) to assess respiratory distress and disordered breathing among participants (10-13). Our sample size of 377 was calculated using Raosoft, and data collection was conducted via social media and the University of South Asia (Lahore Cantt). Our findings revealed that 63.66% of COVID-19 survivors experienced HVS, highlighting it as a significant post-COVID-19 complication that affects quality of life (QOL). These results underscore the importance of further research into treatment strategies for managing HVS in COVID-19 survivors and the potential role of cardiopulmonary physiotherapy in mitigating these symptoms (14).

MATERIAL AND METHODS

The study received approval from the Institutional Ethical Review Board and adhered to the principles outlined in the Declaration of Helsinki. This cross-sectional study aimed to investigate the prevalence of Hyperventilation Syndrome (HVS) among COVID-19 recovered patients. Data collection was conducted from COVID-19 recovered individuals through social media platforms, particularly the COVID Warriors group on Facebook, and from the University of South Asia (Lahore Cantt). The sample size was calculated using Raosoft software, with a 5% margin of error and a confidence level, resulting in a total of 377 participants (15).

Participants included in the study were aged between 17 and 60 years, of both genders, and had previously tested positive for COVID-19 via PCR within the last year. Both vaccinated and non-vaccinated individuals were eligible to participate. Exclusion criteria comprised any history of respiratory conditions such as asthma, chronic obstructive pulmonary disease, pneumonia, chronic bronchitis, and those who had not undergone a PCR test for COVID-19. Informed written consent was obtained from all participants before their inclusion in the study (16).

The Nijmegen Questionnaire (NQ) was employed as the primary tool for measuring outcomes, assessing symptoms of respiratory distress and disordered breathing. The NQ scores range from 0 to 64, with scores above 23 indicating the presence of respiratory distress. Data were collected through an online survey platform, ensuring that participants could complete the questionnaire remotely (17).

Statistical analysis was conducted using SPSS version 25. Categorical data were presented as frequencies and percentages, while continuous data were summarized using means and standard deviations. The analysis focused on determining the prevalence of HVS among the study population and exploring the demographic characteristics of the participants. The ethical considerations of the study were rigorously maintained, ensuring participant confidentiality and data integrity throughout the research process.

By adhering to these rigorous methodological standards, the study aimed to provide a comprehensive assessment of the prevalence and characteristics of HVS in COVID-19 recovered patients, contributing valuable insights to the understanding of post-COVID-19 complications.

RESULTS

The study included a total of 377 participants, aged between 17 and 60 years, with a mean age of 29.92 years and a standard deviation of 9.734. Among the participants, 148 (39.26%) were male and 229 (60.74%) were female. The majority of the participants were not hospitalized for COVID-19, with 309 (82.0%) quarantined at home and 68 (18.0%) requiring hospitalization.

Out of the total participants, 302 (80.1%) had received COVID-19 vaccination, while 75 (19.9%) were not vaccinated. Various vaccines were administered among the vaccinated participants: Sinovac (126, 33.4%), Pfizer (62, 16.4%), CanSino (32, 8.5%), Moderna (45, 11.9%), Sinopharm (34, 9.0%), and Sputnik doses (4, 1.1%). None of the participants had traveled out of the country recently.

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Table 1: Population Characteristics

Characteristic	Frequency	Percentage
Gender		
Male	148	39.26%
Female	229	60.74%
Marital Status		
Married	148	38.7%
Unmarried	229	61.3%
Occupation		
Working	131	34.7%
Not working	246	65.3%
When COVID-19 Symptoms First Noticed		
1-3 months	122	32.4%
3-6 months	49	13.0%
6-9 months	92	24.4%
9-12 months	114	30.2%
Admitted to Hospital		
Yes	68	18.0%
No	309	82.0%
Quarantine Duration at Home		
No quarantine	68	18.0%
14 days	162	43.0%
More than 14 days	119	31.6%
Less than 14 days	28	7.4%
COVID-19 Vaccination		
Yes	302	80.1%
No	75	19.9%
Type of Vaccination		
No Vaccinated	75	19.9%
Sinovac	126	33.4%
Pfizer	62	16.4%
CanSino	32	8.5%
Moderna	45	11.9%
Sinopharm	34	9.0%
Sputnik Doses	4	1.1%
Recent Out of Country Travel		
Yes	0	0.0%
No	377	100.0%

Nijmegen Questionnaire (NQ) Symptoms

The symptoms assessed by the NQ revealed that chest pain (0.27%), stiffness of fingers (9.02%), dyspnea (9.3%), bloated feeling in stomach (7.16%), and inability to take deep breaths (7.16%) were observed least frequently. Conversely, feeling of anxiety (41.91%), palpitations (20.95%), feeling of confusion (13.26%), feeling tense (11.41%), dizzy spells (10.88%), and blurred vision (37.93%) were the most commonly reported symptoms.

Table 2: Scoring of Nijmegen Questionnaire Variables

Symptom	Frequency (%)
Chest pain	0.27%
Stiffness of fingers	9.02%
Dyspnea	9.3%

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Symptom	Frequency (%)
Bloated feeling in stomach	7.16%
Inability to take deep breaths	7.16%
Feeling of anxiety	41.91%
Palpitations	20.95%
Feeling of confusion	13.26%
Feeling tense	11.41%
Dizzy spells	10.88%
Blurred vision	37.93%

Prevalence of Hyperventilation Syndrome

The overall scoring of the NQ indicated that 63.66% of COVID-19 survivors were suffering from Hyperventilation Syndrome, while 36.34% of participants were not experiencing HVS.

Table 3: NQ Score

NQ Score Classification	Frequency	Percentage
HVS Present	240	63.66%
HVS Absent	137	36.34%

These findings suggest that Hyperventilation Syndrome is a significant post-COVID-19 complication, affecting a majority of the survivors in the study.

DISCUSSION

The study revealed a high prevalence of Hyperventilation Syndrome (HVS) among COVID-19 recovered patients, with 63.66% of the participants exhibiting symptoms consistent with HVS. This finding is significant, as it underscores the persistent nature of respiratory complications in COVID-19 survivors. Previous research has indicated similar trends, with studies reporting persistent cardiorespiratory issues, including hyperventilation, several months after recovery from COVID-19 (12). These studies align with our findings, suggesting that hyperventilation is a common post-acute sequela in COVID-19 survivors.

The study's strength lies in its robust sample size and the use of the Nijmegen Questionnaire (NQ), a validated tool for assessing HVS. The sample was diverse, including both male and female participants across a wide age range, which enhances the generalizability of the findings. Additionally, the high response rate and the comprehensive data collection through online platforms allowed for a thorough assessment of HVS prevalence (13).

However, the study also had several limitations. The use of non-probability convenience sampling might have introduced selection bias, as participants with access to social media and those willing to participate might differ systematically from those who did not participate. This could affect the generalizability of the results to the broader population. Furthermore, the reliance on self-reported data could introduce reporting bias, as participants may have underreported or overreported their symptoms (14).

Despite these limitations, the study provides valuable insights into the prevalence of HVS among COVID-19 recovered patients. The findings highlight the need for continued monitoring and management of respiratory symptoms in COVID-19 survivors. Given the high prevalence of HVS, healthcare providers should consider incorporating routine screening for hyperventilation in post-COVID care protocols. Interventions such as breathing exercises and physiotherapy could be beneficial in managing HVS symptoms and improving the quality of life for these patients (15-17).

Future research should focus on longitudinal studies to track the persistence of HVS symptoms over time and evaluate the effectiveness of various intervention strategies (18). Additionally, exploring the underlying mechanisms of HVS in COVID-19 survivors could provide a deeper understanding of the condition and inform targeted treatment approaches. Studies should also aim to include more diverse populations and employ probability sampling methods to enhance the representativeness of the findings (21).

CONCLUSION

In conclusion, this study contributes to the growing body of evidence on post-COVID-19 complications, specifically the high prevalence of HVS among survivors. It underscores the importance of comprehensive post-acute care and the need for targeted interventions to manage respiratory symptoms in this population. The findings call for further research and clinical attention to address the long-term respiratory health of COVID-19 survivors.

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REFERENCES

1. Wilson CJ. Hyperventilation Syndrome: Diagnosis And Reassurance. J Psychopharmacol. 2018;10(9):370-5.
2. Williams CY, Williams RW, Knight R, Hashmi S, Donnelly N, Bance M, et al. Hyperventilation Syndrome: Investigating The Relationship Between Nijmegen Questionnaire, Vestibular Function Tests, And Patient Symptoms. Otol Neurotol. 2020;41(3).
3. O'Reilly V, Patout M, Jackson B, Patel A. The Nijmegen Questionnaire: A Valid Measure For Hyperventilation Syndrome. J Physiother. 2019;47(3):160-71.
4. Motiejunaite J, Balagny P, Arnoult F, Mangin L, Bancal C, D'Ortho MP, et al. Hyperventilation: A Possible Explanation For Long-Lasting Exercise Intolerance In Mild COVID-19 Survivors? Front Physiol. 2021;11:1856.
5. Taverne J, Salvator H, Leboulch C, Barizien N, Ballester M, Imhaus E, et al. High Incidence Of Hyperventilation Syndrome After COVID-19. Eur Respir J. 2021;13(6):3918.
6. Bouteleux B, Henrot P, Ernst R, Grassion L, Raherison-Semjen C, Beaufils F, et al. Respiratory Rehabilitation For COVID-19 Related Persistent Dyspnoea: A One-Year Experience. Respir Med. 2021;189:106648.
7. Crisafulli E, Gabbiani D, Magnani G, Dorelli G, Busti F, Sartori G, et al. Residual Lung Function Impairment Is Associated With Hyperventilation In Patients Recovered From Hospitalised COVID-19: A Cross-Sectional Study. Eur Respir J. 2021;10(5):1036.
8. Motiejunaite J, Balagny P, Arnoult F, Mangin L, Bancal C, Vidal-Petiot E, et al. Hyperventilation As One Of The Mechanisms Of Persistent Dyspnoea In SARS-CoV-2 Survivors. Eur Respir J. 2021;58(2).
9. Naeije R, Caravita S. Phenotyping Long COVID. Eur Respir J. 2021.
10. Singh I, Joseph P, Heerdt PM, Cullinan M, Lutchmansingh DD, Gulati M, et al. Persistent Exertional Intolerance After COVID-19: Insights From Invasive Cardiopulmonary Exercise Testing. Eur Respir J. 2021.
11. Skjørten I, Ankerstjerne OAW, Trebinjac D, Brønstad E, Rasch-Halvorsen Ø, Einvik G, et al. Cardiopulmonary Exercise Capacity And Limitations 3 Months After COVID-19 Hospitalisation. Eur Respir J. 2021;58(2).
12. Morin L, Savale L, Pham T, Colle R, Figueiredo S, Harrois A, et al. Four-Month Clinical Status Of A Cohort Of Patients After Hospitalization For COVID-19. JAMA. 2021;325(15):1525-34.
13. Parpa K, Michaelides M. The Effect Of COVID-19 Infection On The Aerobic Capacity Of Professional Soccer Players. Int J Sports Med. 2021.
14. Armange L, Bénézit F, Picard L, Pronier C, Guillot S, Lentz PA, et al. Prevalence And Characteristics Of Persistent Symptoms After Non-Severe COVID-19: A Prospective Cohort Study. Eur Respir J. 2021:1-5.
15. Aparisi Á, Ybarra-Falcón C, García-Gómez M, Tobar J, Iglesias-Echeverría C, Jaurrieta-Largo S, et al. Exercise Ventilatory Inefficiency In Post-COVID-19 Syndrome: Insights From A Prospective Evaluation. Eur Respir J. 2021;10(12):2591.
16. Huang Y, Tan C, Wu J, Chen M, Wang Z, Luo L, et al. Impact Of Coronavirus Disease 2019 On Pulmonary Function In Early Convalescence Phase. Thorax. 2020;21(1):1-10.
17. Chen R, Gao Y, Chen M, Jian W, Lei C, Zheng J, et al. Impaired Pulmonary Function In Discharged Patients With COVID-19: More Work Ahead. Thorax. 2020;56(1).
18. Dhont S, Derom E, Van Braeckel E, Depuydt P, Lambrecht BN. The Pathophysiology Of 'Happy' Hypoxemia In COVID-19. Respir Res. 2020;21(1):1-9.
19. Mahjoub Y, Rodenstein DO, Jounieaux V. Severe COVID-19 Disease: Rather AVDS Than ARDS? Crit Care. 2020;24(1):1-2.
20. Matricardi PM, Dal Negro RW, Nisini R. The First, Holistic Immunological Model Of COVID-19: Implications For Prevention, Diagnosis, And Public Health Measures. Pediatr Allergy Immunol. 2020;31(5):454-70.
21. Courtney R, Greenwood KM, Cohen M. Relationships Between Measures Of Dysfunctional Breathing In A Population With Concerns About Their Breathing. J Bodyw Mov Ther. 2011;15(1):24-34.