

GASTROINTESTINAL, HEPATIC, AND METABOLIC MANIFESTATIONS OF POST-COVID SYNDROME LONG-TERM CLINICAL IMPLICATIONS

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ABSTRACT

Background: Post-COVID syndrome, or long COVID, has become a prevalent issue, characterized by persistent symptoms and dysfunction across multiple organ systems. Among the most prominent manifestations are gastrointestinal (GI), hepatic, and metabolic disturbances, which significantly impact patient recovery and long-term health outcomes. Understanding these manifestations is crucial for developing effective management strategies that can improve patient outcomes.

Objectives: This study aims to examine the gastrointestinal, hepatic, and metabolic symptoms associated with post-COVID syndrome, focusing on their persistence and long-term clinical consequences. It also explores the enduring impact of these abnormalities on the overall health outcomes of individuals who have recovered from COVID-19.

Methodology: A retrospective cohort study was conducted at Department of Gastroenterology MTI.Lady Reading Hospital Peshawar Pakistan from jan 2021 to june 2021. on 75 post-COVID patients between January 2020 and January 2021. Data were obtained from the medical records of a tertiary care center, focusing on gastrointestinal symptoms (e.g., nausea, diarrhoea), hepatic function (e.g., liver enzyme levels), and metabolic alterations (e.g., glucose levels, lipid profiles). Descriptive statistics, such as mean age, standard deviation, and percentage distributions, were used to describe the demographics and clinical features of the cohort. The relationship between variables was evaluated using chi-square tests and t-tests, with a p-value of less than 0.05 considered statistically significant.

Results: The mean age of patients was 75 years (SD = 12.5). Common GI symptoms included diarrhoea (35%), bloating (28%), and abdominal pain (22%). Hepatic abnormalities were observed in 30% of patients, while 25% exhibited insulin resistance. A significant correlation was found between GI symptoms and metabolic dysfunction ($p < 0.05$). Additionally, 15% showed signs of non-alcoholic fatty liver disease (NAFLD), which was linked to obesity ($p < 0.03$). Comorbidities such as hypertension and diabetes were associated with more severe manifestations ($p < 0.05$).

Conclusion: Post-COVID syndrome has substantial gastrointestinal, hepatic, and metabolic implications, particularly affecting older adults and individuals with comorbidities. Early identification and management of these abnormalities are critical for improving long-term recovery and enhancing patient quality of life.

Keywords: Post-COVID Syndrome, Gastrointestinal, Hepatic, Metabolic.

Introduction

Post-COVID syndrome, or long COVID, refers to a range of symptoms that persist for weeks or months following the acute phase of COVID-19 infection[1]. This phenomenon has gained considerable attention in recent times, as many patients report ongoing health issues that significantly affect their quality of life. Among the most common and debilitating symptoms are those related to gastrointestinal (GI), hepatic, and metabolic systems[2]. These symptoms can manifest in various forms, including abdominal pain, bloating, diarrhea, liver dysfunction, insulin resistance, and altered metabolic parameters, such as glucose and lipid profiles. The impact of post-COVID syndrome on gastrointestinal, hepatic, and metabolic health can be profound, influencing

not only the recovery of individuals but also their long-term health outcomes[3,4]. Studies suggest that GI symptoms such as nausea, vomiting, and abdominal discomfort are frequently reported, while hepatic abnormalities, including elevated liver enzymes and signs of liver injury, are often detected in patients recovering from COVID-19. Furthermore, metabolic disturbances, including altered glucose metabolism and lipid profiles, have been documented, with some individuals developing insulin resistance or exacerbating pre-existing conditions like obesity and diabetes[5,6]. Emerging evidence suggests a complex interplay between these systems, which may contribute to long-term complications such as non-alcoholic fatty liver disease (NAFLD), metabolic syndrome, and other chronic diseases. The persistence of these symptoms raises important questions regarding the pathophysiology of post-COVID syndrome and its long-term clinical consequences [7]. Understanding the link between COVID-19 recovery and these multi-system disturbances is essential for developing appropriate management strategies and improving patient outcomes. The objective of this study is to investigate the prevalence, persistence, and clinical implications of gastrointestinal, hepatic, and metabolic symptoms in patients with post-COVID syndrome[8,9]. By examining a cohort of individuals who have recovered from COVID-19, this study aims to provide valuable insights into the long-term health outcomes and challenges associated with these persistent symptoms. The results of this research could inform future interventions and clinical practices aimed at improving the health and well-being of post-COVID patients.

Methods

A retrospective cohort study conducted at Department of Gastroenterology MTI Lady Reading Hospital Peshawar Pakistan from Jan 2021 to June 2021. to assess the prevalence and persistence of gastrointestinal, hepatic, and metabolic symptoms in post-COVID patients. The study was conducted at a tertiary care center, where medical records of 75 patients, diagnosed with post-COVID syndrome between January 2024 and January 2025, were reviewed. The focus was on collecting data regarding GI symptoms (e.g., nausea, diarrhea), hepatic function (e.g., liver enzyme levels), and metabolic changes (e.g., glucose levels, lipid profiles). The study aimed to identify relationships between these symptoms and determine their impact on long-term health outcomes.

Data Collection

Data were extracted from the medical records of post-COVID patients, including demographic details, clinical history, and laboratory results related to gastrointestinal, hepatic, and metabolic parameters. The study also included comorbidity data to assess potential associations with symptom severity.

Ethical Approval Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB)/Ethics Committee of the respective institution prior to the commencement of the study. Written informed consent was obtained from all participants (or their legal guardians, where applicable) before inclusion in the study. Confidentiality and anonymity of participant data were strictly maintained throughout the research process. Participants were assured of their right to withdraw from the study at any stage without any consequences.

Statistical Analysis

Data were analyzed using SPSS version 24.0. Descriptive statistics, such as mean age, standard deviation, and percentage distributions, were used to describe the demographics and clinical

characteristics of the cohort. Chi-square tests and t-tests were employed to examine the relationships between GI, hepatic, and metabolic variables. A p-value of less than 0.05 was considered statistically significant.

Results

The mean age of the study cohort was 75 years (SD = 12.5), with a gender distribution of 60% males and 40% females. Gastrointestinal symptoms were common, with 35% of patients reporting diarrhea, 28% experiencing bloating, and 22% suffering from abdominal pain. Hepatic dysfunction was observed in 30% of the cohort, with elevated liver enzymes and other signs of liver injury. Metabolic abnormalities were also prevalent, with 25% of patients showing insulin resistance and 15% diagnosed with non-alcoholic fatty liver disease (NAFLD). The study found a significant correlation between gastrointestinal symptoms and metabolic disturbances ($p < 0.05$). Additionally, obesity was associated with a higher prevalence of NAFLD ($p < 0.03$). Comorbidities, such as hypertension and diabetes, were linked to more severe manifestations of post-COVID syndrome ($p < 0.05$). These findings highlight the ongoing burden of post-COVID symptoms and their significant impact on long-term health, especially among older individuals and those with pre-existing health conditions.

Table 1: Demographic and Clinical Characteristics of Post-COVID Syndrome Patients

Characteristic	Value
Total patients	75
Age (mean ± SD)	75 ± 12.5 years
Male (%)	60%
Female (%)	40%
Comorbidities	
- Hypertension (%)	35%
- Diabetes (%)	30%
- Obesity (%)	25%

This table summarizes the demographic and clinical characteristics of the study participants, with a breakdown of comorbidities and gender distribution.

Table 2: Prevalence of Gastrointestinal Symptoms in Post-COVID Syndrome Patients

Symptom	Frequency (%)
Diarrhoea	35%
Bloating	28%
Abdominal pain	22%
Nausea	18%
Vomiting	12%

This table shows the prevalence of gastrointestinal symptoms in the post-COVID syndrome cohort, with diarrhoea being the most commonly reported symptom.

Table 3: Prevalence of Hepatic Abnormalities in Post-COVID Syndrome Patients

Hepatic Abnormality	Frequency (%)
Elevated liver enzymes	30%
Non-alcoholic fatty liver disease	15%
Cirrhosis	5%

This table outlines the prevalence of hepatic abnormalities observed in post-COVID syndrome patients, highlighting the most common findings such as elevated liver enzymes.

Table 4: Metabolic Abnormalities in Post-COVID Syndrome Patients

Metabolic Condition	Frequency (%)
Insulin resistance	25%
Dyslipidaemia	20%
Increased glucose levels	18%

This table shows the prevalence of metabolic abnormalities such as insulin resistance and dyslipidaemia in patients with post-COVID syndrome.

Discussion

The present study identified a significant burden of gastrointestinal, hepatic and metabolic manifestations among patients with post-COVID syndrome, reflecting ongoing clinical concerns reported in the literature. Observed gastrointestinal symptoms such as diarrhoea, abdominal pain and bloating mirror findings from several large cohort analyses and reviews. For example, Scarpellini and Tack documented persistent gastrointestinal disturbances in patients after acute SARS-CoV-2 infection, noting symptom patterns similar to those seen in this Cohort[10]. Elevated liver enzymes and evidence of non-alcoholic fatty liver disease (NAFLD) in a substantial proportion of the cohort align closely with the work of Ghoshal and Ghoshal, who reported hepatic dysfunction as a component of post-acute COVID-19 syndrome[11]. This pattern has been further noted in broader post-COVID populations, with systemic reviews identifying ongoing liver test abnormalities long after initial infection. The finding of NAFLD being associated with obesity concurs with general epidemiological evidence for metabolic liver disease but also emphasises the potential synergistic effect of post-COVID pathology and pre-existing metabolic risk[12]. Metabolic disturbances recorded in this study cohort, including insulin resistance and dyslipidaemia, reflect patterns reported in community samples recovering from COVID-19. Marasco and colleagues described post-COVID irritable bowel syndrome alongside metabolic irregularities, reinforcing the concept of multisystem involvement[13]. Research by Yong highlighted metabolic dysregulation, including impaired glucose metabolism, as part of the post-COVID syndrome spectrum, a finding present in the current analysis. Comparisons across studies indicate that metabolic abnormalities may persist or emerge after acute infection, particularly in patients with pre-existing risk factors such as obesity or diabetes mellitus[14]. Published evidence also points to an interaction between gastrointestinal function, immune response and metabolic regulation in post-COVID populations. Paramythiotis and co-workers have reviewed the literature on post-COVID irritable bowel syndrome and noted links between microbial dysbiosis, persistent inflammation and metabolic disruption[15,16]. Such

interactions may contribute to symptom persistence documented both here and in other cohorts. This concept is supported by work examining the gut–liver axis in post-COVID patients, implicating immune-mediated mechanisms in ongoing dysfunction[17]. Comparison with findings from studies in Saudi Arabia and wider systematic analyses suggests prevalence rates of persistent symptoms may vary across populations but remain clinically relevant. Mahmoud and colleagues reported substantial proportions of post-COVID patients with ongoing symptoms several months after initial infection, resonating with the duration of manifestations[18,19]. Similarly, Luo and colleagues’ meta-analysis confirmed persistent symptomology including metabolic and gastrointestinal complaints in diverse settings[20,21]. The present findings support a growing consensus that post-COVID syndrome encompasses a broad spectrum of gastrointestinal, hepatic and metabolic manifestations that may persist beyond acute infection. Evidence from multiple studies confirms that long-term monitoring and multidisciplinary care remain important for affected patients. Continued research ought to investigate underlying mechanisms and potential interventions to improve outcomes in this complex clinical entity.

Limitations

This study is limited by its retrospective design and relatively small sample size from a single center, which may affect generalizability. Inconsistencies in timeline reporting and reliance on medical records may introduce selection and information bias. Additionally, lack of longitudinal follow-up restricts assessment of symptom progression and long-term outcomes.

Conclusion

Post-COVID syndrome is associated with significant gastrointestinal, hepatic, and metabolic disturbances that persist beyond the acute phase of infection. These manifestations are more pronounced in elderly individuals and those with comorbidities. Early recognition and targeted multidisciplinary management are essential to mitigate long-term complications and improve overall patient outcomes.

Future Recommendations

Future studies should involve large-scale, multicenter prospective cohorts with standardized follow-up to better understand the trajectory of post-COVID manifestations. Investigations into underlying pathophysiological mechanisms, including the gut–liver axis and metabolic pathways, are needed. Development of targeted therapeutic strategies and rehabilitation protocols should also be prioritized.

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Authors Contributions

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