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An Emergency Service Example During the Pandemic: Bandırma

ABSTRACT

Background: The ongoing global pandemic has underscored the pressing need to comprehend the long-term ramifications of the condition on those who have survived, with a particular emphasis on respiratory health. The present study investigates the association between a history of infection with the SARS-CoV-2 virus and the outcome of a subsequent acute respiratory disease in hospitalized patients, with the objective of elucidating the long-term respiratory implications of the disease.

Methods: The present retrospective study analyzed data from 394 patients admitted to the emergency department with acute respiratory conditions and hospitalized between November 2022 and March 2023. The data set included demographics, comorbidities, and history of SARS-CoV-2 infection, as well as the primary outcome data (death or intensive care unit admission).

Results: Among 394 patients, a history of infection with the novel coronavirus was associated with a significant increase in adverse outcomes, including death or admission to the intensive care unit. The risk exhibited variation according to the severity of the preceding infection; patients receiving ICU treatment exhibited a higher risk, while those treated in wards exhibited a lower risk. Multivariate analysis identified diabetes, Alzheimer's disease and dementia, and ICU treatment for previous severe acute respiratory syndrome as significant predictors of adverse outcomes, while benign prostatic

hyperplasia (BPH) and ward treatment emerged as protective factors.

Conclusions: The findings emphasize the significance of customized post-discharge care and underscore the necessity for ongoing research to elucidate the long-term ramifications of the novel coronavirus, thereby facilitating more effective clinical management and enhancing patient outcomes.

Keywords: COVID, Emergency Medicine, Outcome

Introduction

The ongoing global pandemic of the novel coronavirus, officially designated as SARS-CoV-2, is primarily characterized as an acute respiratory illness. This virus has resulted in millions of deaths and significant morbidity worldwide, despite the rapid introduction of highly effective vaccines (1).

While a considerable proportion of patients have experienced complete recovery following the acute phase of the illness, a significant subset has continued to manifest symptoms for an extended period. Furthermore, it has been observed that the disease may result in lasting damage beyond the post-acute phase, leading to the definition of "post-covid-19 syndrome (PCS)" or "long-covid-19." The prevalence of this condition is estimated to be between 10% and 25% even in outpatient settings, and potentially higher among hospitalized patients (2).

It has been observed that a significant proportion of patients continue to experience symptoms of the novel coronavirus for a period of time extending beyond six months following the onset of the infection. A study of 2,000 individuals revealed that approximately two-thirds of patients exhibited at least one symptom, such as fatigue or respiratory distress, and nearly half of them still reported symptoms during the first year (3). Additionally, impairments have been observed in tests such as walking tests and pulmonary diffusion capacity at the three-month mark (4). The presence of cardiopulmonary damage and functional deficits has been associated with the novel coronavirus. While a number of mechanisms related to the prolonged effects of the novel coronavirus (SARS-CoV-2) have been proposed, including virus-related organ damage, persistent inflammation, immune dysregulation, and hypercoagulability, the exact mechanisms remain unclear (7,8). Furthermore, knowledge regarding long-term cardiopulmonary disorders and their consequences in individuals who have recovered from the disease is limited.

The long-term implications of the novel virus remain uncertain, as the current data do not allow for determination of whether mortality rates will increase in the long term due to underlying chronic lung disease or the development of new acute lung conditions. This information has the potential to influence clinical management and the significance of a history of prior infection with the virus.

The objective of this study is to examine the association between the course of acute respiratory disease and the history of prior infection with the novel coronavirus, SARS-CoV-2, in patients presenting to the emergency department with acute respiratory illness and requiring hospitalization.

Methods

Patients

In this retrospective study, a total of 120,747 patients who were admitted to the emergency care unit between November 2022 and March 2023 were screened, and 394 eligible patients were included in the study. Patients who admitted to an acute pulmonary condition as their primary ailment and were ultimately hospitalized for this condition were included in the study. Furthermore, to qualify, patients had to be at least 18 years of age, and their data

concerning previous cases of COVD had to be both available and accessible. A subsequent analysis of the hospital records of the patients was conducted, and the relevant study data were retrieved. The study's inclusion criteria were limited to hospitalized patients, excluding those receiving outpatient care. Patients who were admitted to the hospital for reasons unrelated to a non-pulmonary condition, as well as those with inadequate data regarding their history of severe acute respiratory syndrome (SARS-CoV-2) on their hospital records, were excluded from the study. The study protocol was approved by the local ethics committee, and the study was conducted in accordance with the Declaration of Helsinki.

Data extraction

A review of existing records was conducted to ascertain hospitalization data and previous history of SARS-CoV-2 infection. The following data were collected: the primary indication for hospitalization (pulmonary condition), co-morbid conditions, and demographic data, in addition to the study outcomes (death and intensive care unit admission). A review of the extant literature was conducted to ascertain the previous history of the novel pathogen. Patients who were admitted to the hospital with respiratory conditions associated with the novel coronavirus (SARS-CoV-2) were also included in the study, along with their medical history, including previous cases of SARS-CoV-2 infection. The combined study endpoint was defined as death (in-hospital death within 30 days of hospitalization) and/or ICU admission. All subsequent analyses were conducted with this endpoint in mind.

Statistical analysis

The analysis of the data was conducted using IBM SPSS Statistics version 21.0 software. The descriptive data are presented in number (percentage) or mean ± standard deviation. Between-group comparisons of categorical variables were conducted using the chi-square test or Fisher's exact test, as appropriate. The Student's t-test for independent samples was employed to facilitate the comparison of continuous variables. Receiver operating characteristic (ROC) curves were generated to identify optimal cut-off points for predicting combined endpoints using the highest Youden Index (sensitivity + specificity - 1). A stepwise logistic regression model was employed to identify the significant independent predictors of the combined endpoint. A p-value greater than 0.05 was considered to be indicative of statistical significance.

Results

Patients

The present study encompassed a total of 394 eligible patients. As illustrated in Table 1, the initial demographic and clinical characteristics of the patient population are presented, along with the subgroup that has a documented history of prior infection with the SARS-CoV-2 virus. This determination is based on a comprehensive review of the patients' medical histories and electronic health records. The most prevalent indication for admission was pneumonia (54.6%), followed by new cases of severe acute respiratory syndrome (SARS) (18.0%) and exacerbations of chronic obstructive pulmonary disease (COPD) (17.3%). The analysis revealed that the majority of the patients (81.7%) exhibited at least one comorbid condition. Approximately 25% of patients had a documented history of prior infection with the virus. As illustrated in Table 2, the most prevalent comorbid conditions were hypertension (34.3%), followed by coronary artery disease (28.4%), chronic obstructive pulmonary disease (24.6%), and diabetes (17.8%). Among patients with a documented history of infection with the SARS-CoV-2 virus, the mean time between the initial infection and the most recent admission was more than one year (450.0 ± 217.1 days; range, 56–937 days).

Table 1. Baseline demographical and clinical characteristics of the patients

Factors	n=394
Age, years (mean±SD)	75.6±12.9
Male sex	248 (63.2%)
Comorbid condition present	322 (81.7%)
Pulmonary hospitalization indication (at present)	
Pneumonia	215 (54.6%)
COVID	71 (18.0%)
COPD attack	68 (17.3%)
Pulmonary embolism	17 (4.3%)
Asthma	7 (1.8%)
Smoke exposure	7 (1.8%)
Pulmonary edema	6 (1.5%)
Pleural effusion	3 (0.8%)
Previous COVID history present	104 (26.4%)
Multiple COVID infection†	12 (11.5%)
Time from COVID infection, days (mean±SD)†*	450.0±217.1
Hospitalization requirement during COVID†	
No hospitalization, at home	6 (5.8%)
Hospitalization, at wards	77 (74.0%)
ICU admission	21 (20.2%)

Unless otherwise stated, data presented in number (percentage). †Percentage of the COVID related factors represents the ratios among patients with COVID infection history. ICU, intensive care unit. *If multiple, time from the first COVID infection

Table 2. Comorbidities present at the time of admission

Comorbidity	n=394
No comorbidity	72 (18.3%)
Multiple comorbidity	195 (49.5%)
Hypertension	135 (34.3%)
Coronary artery disease	112 (28.4%)
Chronic obstructive pulmonary disease	97 (24.6%)
Diabetes	70 (17.8%)
Malignancy	40 (10.2%)
Cerebrovascular accident (previous)	39 (9.9%)
Benign prostate hyperplasia	33 (8.4%)
Asthma	23 (5.8%)
Alzheimer/Dementia	19 (4.8%)
Congestive heart failure	19 (4.8%)
Chronic renal failure	10 (2.5%)
Epilepsy	3 (0.8%)
Other*	22 (5.6%)

Data presented in number (percentage)
*Other comorbidities include tuberculosis, interstitial lung disease, lung fibrosis, bronchiectasis, peripheral vascular disease, heart transplantation, Parkinson's disease, mental retardation, down syndrome, romatoid arthritis, ulcerative collitis

Factors affecting combined endpoint (death or ICU admission)

A previous history of SARS-CoV-2 infection was found to be associated with a significant association with the development of the combined endpoint (p = 0.024). However, two subgroups exhibited relationships with opposite directions. Specifically, a history of previous SARS-CoV-2 infection treated in a hospital ward was associated with a smaller risk for the combined endpoint. Conversely, a history of previous SARS-CoV-2 infection treated in the intensive care unit (ICU) was associated with a higher risk (Table 3). As illustrated in Table 3, a univariate and multivariate analysis of factors that may affect the combined endpoint is presented. Furthermore, univariate analysis revealed that advanced age, female gender, a high number of comorbid conditions, and three comorbid conditions (cerebrovascular accident, diabetes, and Alzheimer/dementia) were associated with a higher risk of the combined endpoint. Conversely, benign prostate hyperplasia and an indication for the latest admission (smoke exposure) were associated with a lower risk. The results of the study indicate that no other factors that were tested were associated with the combined endpoint risk, including other comorbidities (see Table 2). These results remained consistent across all other indicators, including other indications for the latest admission, time from the most recent infection with SARS-CoV-2, history of multiple infections with SARS-CoV-2, and previous infections with SARS-CoV-2 treated at home. Multivariate analysis identified diabetes (odds ratio [OR]: 2.3), Alzheimer's disease and dementia (OR: 10.9), and intensive care unit (ICU) treatment for the previous severe acute respiratory syndrome (SARS)-CoV-2 infection (OR: 3.8) as significant independent predictors of increased risk for the combined endpoint (Table 3). Conversely, benign prostate hyperplasia (OR: 0.2) and hospital ward treatment for the previous COVIID injection (OR: 0.2) emerged as significant independent

predictors of a lower risk of the combined endpoint (Table 3).

Discussion

The consequences of the novel coronavirus disease (NCD) 2019, persisting well beyond the acute phase of recovery, pose a multifaceted challenge to healthcare systems globally (9). The present study aimed to examine the relationship between acute respiratory disease outcomes and a previous history of NCD, with a particular focus on hospitalized individuals. The investigation's significance is underscored by the mounting recognition of the novel coronavirus not solely as a severe acute illness but also as a condition with the potential to manifest chronic health implications, particularly in the respiratory system. To the best of our knowledge, this is the first study examining the effect of the history of SARS-CoV-2 infection on the outcome of acute respiratory conditions later in life.

The findings of the present study indicate a pronounced association between previous infection with the novel coronavirus and an increased risk of adverse respiratory outcomes, including death or admission to the intensive care unit (ICU), among individuals hospitalized for acute respiratory conditions. This finding is consistent with the emerging body of literature on post-acute sequelae of the disease, which suggests that individuals who have recovered from a bout of severe acute respiratory syndrome (SARS-CoV-2) may experience persistent health issues, including respiratory dysfunction. For instance, studies have reported long-term pulmonary abnormalities post-covid, ranging from reduced diffusion capacity to the manifestation of fibrotic changes, which may explain the unfavorable outcomes found in the present study in association with the history of disease, particularly after a severe attack (3, 10, 11).

The present study offers insights into the differential impact of the severity of the novel coronavirus on long-term respiratory health by delineating outcomes based on the level of care (wards vs. intensive care unit [ICU]). Severe cases of the novel coronavirus disease (NCD) have been observed to result in acute respiratory distress syndrome (ARDS), which can lead to significant pulmonary fibrosis and chronic lung disease, often requiring intensive care unit (ICU) admission (12). In contrast, patients with less severe NCDs who receive treatment in wards may not experience the same extent of structural lung damage, potentially resulting in enhanced long-term pulmonary functionality. This discrepancy in findings between the two groups, those treated in the wards and those treated in the ICU, may offer insight into the differential outcomes observed in the present study. A multitude of studies have reported findings that are consistent with this hypothesis, suggesting that patients with severe cases of the disease may experience more severe pulmonary consequences, while those with less severe cases may experience relatively milder consequences. A recent study by Huang et al. examined the long-term effects of mild to moderate but not severe cases of SARS-CoV-2 infection in hospitalized patients. The study found that patients exhibited persistent symptoms six months after initial infection, with no significant impact on long-term pulmonary function (13). As indicated by the findings of a systematic review and meta-analysis of long-term physical and mental sequelae of the novel coronavirus disease (nCoV-19), patients with severe acute infections exhibited impaired pulmonary diffusion capacities and abnormal chest imaging manifestations at six months (14). The review identified more severe status at the time of acute infection as a risk factor for long-term sequelae. Fifteen: In a long-term respiratory follow-up of ICU-hospitalized patients with confirmed cases of severe acute respiratory syndrome (SARS) caused by the novel coronavirus (nCoV), the

presence of respiratory alterations was still evident six to twelve months after hospital admission. The following factors were identified as risk factors for the development of structural lesions: male sex, prolonged ICU stay, and prolonged intermittent mandatory ventilation (15, 16). Similarly, several other studies have supported the possible relation between the severity of acute SARS disease and the severity of pulmonary sequelae (17, 18).

Conversely, for patients with less severe disease, the hospitalization period may present a unique opportunity for healthcare providers to identify and manage pre-existing or co-morbid pulmonary conditions that may be exacerbated by the novel virus. This early intervention has the potential to yield enhanced respiratory outcomes for patients treated in wards, as opposed to those with severe disease managed in the ICU, where the emphasis is frequently on acute survival rather than long-term health optimization. This observation may offer a partial explanation for the observed improvement in acute respiratory disease outcomes among patients treated in non-ICU wards.

The recommendation for a structured, multidisciplinary approach to post-discharge care of COVID-19 survivors seems to be of great importance. Regular monitoring, especially of lung function and rehabilitation needs, would be essential for identifying and addressing long-term sequelae; in addition, conducting longitudinal studies and analyzing registries to better understand and manage the chronic impacts of COVID-19 on respiratory health would be of great help (19-21). Moreover, the importance of early intervention and identification of co-morbid conditions during hospitalization cannot be overstated. Furthermore, the integration of multidisciplinary rehabilitation programs could play a crucial role in addressing the broad spectrum of long-term effects associated with COVID-19, leading to a better recovery process for affected individuals.

The limitations of this study, notably its retrospective design and the reliance on hospital records, highlight the need for further prospective and longitudinal research. Such studies would provide more definitive insights into the causal relationships between COVID-19 and long-term respiratory outcomes and help identify effective interventions to mitigate these effects.

In summary, the present study contributes to the growing body of evidence regarding the long-term respiratory implications of the novel coronavirus disease (NCD) caused by severe acute respiratory syndrome (SARS) CoV-2. The differential outcomes observed between patients treated in wards versus those in ICUs underscore the need for targeted post-discharge strategies tailored to the severity of the initial illness. As we persist in our navigation of the long-term repercussions of the novel coronavirus disease (NCD) pandemic, it is imperative to concentrate on two primary aspects: acute management and long-term rehabilitation. This dual approach is instrumental in maximizing respiratory health outcomes in survivors.

Table 3. Univariate and multivariate analysis of factors that may affect combined end point (death or ICU admission (n=394)

Parameter	**No death or ICU admission (n=248)**	**Death or ICU admission (n=146)**	**Univariate p**	**Multivariate OR (95% CI), p**
Age				
<73 y	128 (68.4%)	59 (31.6%)	0.032	
≥73 y	120 (58.0%)	87 (42.0%)		
Sex				
Male	166 (66.7%)	83 (33.3%)	0.045	
Female	82 (56.6%)	63 (43.4%)		
Comorbidities (n)				
<3	208 (66.5%)	105 (33.5%)	0.005	
≥3	40 (49.4%)	41 (50.6%)		
Comorbidity - CVA				
Absent	230 (64.8%)	125 (35.2%)	0.022	
Present	18 (46.2%)	21 (53.8%)		
Comorbidity - Diabetes				
Absent	216 (66.7%)	108 (33.3%)	0.001	**2.3 (1.2-4.4), 0.013**
Present	32 (45.7%)	38 (54.3%)		
Comorbidity - BPH				
Absent	222 (61.5%)	139 (38.5%)	0.049	**0.2 (0.1-0.7), 0.006**
Present	26 (78.8%)	7 (21.2%)		
Comorbidity – Alzheimer/Dementia				
Absent	245 (65.3%)	130 (34.7%)	<0.001	**10.9 (2.3-52.8), 0.003**
Present	3 (15.8%)	16 (84.2%)		
Previous COVID - treatment at hospital wards				
No	182 (57.4%)	135 (42.6%)	<0.001	**0.2 (0.1-0.4), <0.001**
Yes	66 (85.7%)	11 (14.3%)		
Previous COVID - treatment at ICU				
No	242 (64.9%)	131 (35.1%)	0.001	**3.8 (1.3-10.9), 0.013**
Yes	6 (28.6%)	15 (71.4%)		
Indication for latest hospitalization - COVID				
No	210 (65.0%)	113 (35.0%)	0.069	
Yes	38 (53.5%)	33 (46.5%)		
Indication for latest hospitalization – Smoke exposure				
No	241 (62.3%)	146 (37.7%)	0.038	
Yes	7 (100.0%)	0 (0.0%)		

Unless otherwise stated, data presented as n (%). Abbreviations: CVA, cerebrovascular accident; BPH, benign prostate hyperplasia, OR, odds ratio; CI, confidence interval. Odds ratios are in reference to the first row

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