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Impact of Nosocomial COVID-19 Infection Among Hospitalized Patients with Respiratory Diseases

Solunum Hastalığı Nedeniyle Hastanede Yatan Hastalarda Nozokomial COVID-19 Hastalığının Etkisi

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Abstract

Objective: There are very few studies concerning the frequency and course of nosocomial Coronavirus disease-2019 (COVID-19) infection among patients hospitalized having diseases other than COVID-19. In our study, patients who were admitted to the pulmonology inpatient clinic from the emergency room due to non-COVID-19 diseases and later diagnosed with COVID-19 (index cases) and the nosocomial transmission caused by these patients and the clinical outcomes were analyzed.

Method: This study was carried out on 44 inpatients without COVID-19 at a pulmonology inpatient clinic during the first wave of COVID-19 pandemic. Oro-nasopharyngeal swab samples were taken at the time of hospitalization to detect COVID-19 by reverse transcription-polymerase chain reaction (RT-PCR) test. The test results of four patients were found to be positive. Due to the risk of nosocomial transmission, the remaining patients were re-evaluated for COVID-19 disease by clinical, radiological, and RT-PCR tests (1 to 3 times, and/or if symptoms developed). All patients were followed up for 30 days after discharge.

Results: Thirty-six males (81%) and 8 females (19%) with a mean age of 65.6±13.6 (31-93) years were included in the study. Twenty-five of these patients had cancer, six had chronic obstructive pulmonary disease exacerbation, four had an aggravation of idiopathic pulmonary fibrosis, three had infected bronchiectasis, two had pulmonary embolisms, and four had other disorders. The RT-PCR test results were found positive in 4 patients. In about two weeks, COVID-19 infection emerged in 16 of the remaining 40 patients, and 10 of them (63% of the infected) died. The RT-PCR test results of patients with COVID-19 infection were found to be positive on day 8.2 averagely (6-13).

Öz

Amaç: Koronavirüs hastalığı-2019 (COVID-19) enfeksiyonu dışı hastalıklar nedeniyle hastanede yatan hastalar arasında nozokomiyal COVID-19 olgu sıklığı ve seyri ile ilgili az sayıda çalışma mevcuttur. Çalışmamızda COVID-19 dışı hastalık nedeni ile acil servisten göğüs hastalıkları servisine yatırılan ve yatıştan sonra COVID-19 enfeksiyonu saptanan hastalar (indeks olgu) ve bu hastaların neden olduğu nozokomiyal bulaşma seyri ve sonuçları incelendi.

Yöntem: Çalışmaya, COVID-19 pandemisinin birinci dalgası sırasında göğüs hastalıkları servisinde akciğer hastalığı tanısı ile yatan 44 hasta dahil edildi. Hastaneye yatış sırasında tüm hastalardan COVID-19 ters transkripsiyon-polimeraz zincir reaksiyonu (RT-PCR) testi için oro-nazofaringeal sürüntü örneği alındı. COVID-19 RT-PCR testi dört hastada pozitif bulundu. Test sonuçları negatif bulunan hastalar nozokomiyal bulaş riski nedeni ile klinik, radyolojik olarak ve RT-PCR testi (1-3 kez, ve/veya semptom geliştiğinde) ile COVID-19 açısından yeniden değerlendirildi. Hastaların tümü taburculuk sonrası 30 gün süreyle takip edildi.

Bulgular: Çalışmaya dahil edilen hastaların %81'i (36) erkek, %19'u (8) kadın ve yaş ortalamaları 65,6±13,6 (31-93) yıl olarak bulundu. Hastaların 25'inde malignite, altısında kronik obstrüktif akciğer hastalığı alevlenmesi, dördünde idiyopatik pulmoner fibrozis alevlenmesi, üçünde enfekte bronşektazi, ikisinde pulmoner emboli ve dördünde farklı akciğer hastalıkları bulunmaktaydı. Dört hastanın COVID-19 RT-PCR testi sonucu pozitif bulundu. Yaklaşık iki hafta içinde 40 hastanın 16'sında COVID-19 enfeksiyonu gelişti ve bu hastaların onu (enfekte olanların %63'ü) hayatını kaybetti. COVID-19 enfeksiyonu gelişen hastaların RT-PCR test sonuçlarının ortalama 8.2. (6-13) günde pozitifleştiği saptandı.

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Abstract

Conclusion: Nosocomial transmission of COVID-19 may create a risk of severe illness and death among vulnerable patients. It is crucial to take necessary measures in order to reduce the risk of COVID-19 transmission in hospitals.

Keywords: COVID-19, hospitalized patients, mortality, nosocomial infection, pulmonary disease

Öz

Sonuç: Akciğer hastalığı bulunan hastalarda nozokomiyal COVID-19 enfeksiyonu gelişimi ağır hastalık ve ölüm için ciddi bir risk oluşturmaktadır. Sağlık kurumlarında COVID-19 enfeksiyonu bulaşma riskini azaltmak için gerekli önlemler alınmalıdır.

Anahtar kelimeler: Akciğer hastalığı, COVID-19, hastanede yatan hastalar, mortalite, nozokomial enfeksiyon

Introduction

The pandemic started in Wuhan, China, at the end of 2019 and spread rapidly worldwide; its cause was identified as severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2), and the disease was named Coronavirus disease-2019 (COVID-19) (1). Over 750 million confirmed cases and over 6.8 million deaths have been reported globally by the second month of 2023 (2). Although the COVID-19 pandemic has reduced its effect at present, it still shows a fluctuating course worldwide and continues to be a potential risk for public health.

SARS-CoV-2 is found in the respiratory secretions and the main route of SARS-CoV-2 transmission is through exposure to respiratory particles carrying the virus. Other modes of transmission are direct contact like shaking hands and airborne transmission of the virus that linger in the air over long periods of time. It can also infect people via contact with contaminated surfaces (3,4). Although studies have shown that SARS-CoV-2 virus maintains its viability on inanimate surfaces for a long time, it has been reported that contamination from surfaces is very rare (5,6). The virus can also be transmitted from asymptomatic carriers or individuals whose symptoms have not yet started (7,8).

With the normalization process, the number of hospitals and clinics accepting patients with non-COVID diseases has increased. When patients with unidentified COVID-19 infection are admitted to these clinics, the risk of nosocomial infection rises. Since COVID-19 infection is not considered in these patients in the first place, the prevention measures against COVID-19 may not be taken adequately (9-11).

There are few studies on the frequency and course of nosocomial COVID-19 cases. In the first weeks of the pandemic in Belgium, it was shown that patients hospitalized for other reasons were infected with the virus; also it was reported that the management of these patients was quite complex during the pandemic (12). In another study evaluating 138 COVID-19 cases hospitalized in Wuhan, it was reported that 12% of these were hospitalized for non-COVID-19 reasons and subsequently diagnosed with nosocomial COVID-19 infection. In this series, while the need for an intensive care unit (ICU) admission was needed by 22% in all COVID-19 patients, 53% of patients with nosocomial transmission required an intensive care unit admission (13). In France, cases of COVID-19 were also reported among patients in the geriatric ward who accepted only non-COVID-19 patients with reverse transcription-polymerase chain reaction (RT-PCR) negativity, and it was emphasized that the virus spreads very rapidly (14). Regarding the 435 COVID-19 cases at a center in the United Kingdom, 11% (n=47) were reported to be definitely, and 4% (n=19) were probably nosocomially transmitted COVID-19 patients. Patients with nosocomial transmission were older and had a high mortality rate (15). Another study reported that nosocomial infections were higher in older and more vulnerable individuals but had no effect on disease severity (16). In our country, there is no study on this subject.

University of Health Sciences Turkey, Yedikule Chest Diseases and Chest Surgery Training and Research Hospital also serves the patients with respiratory diseases requiring hospitalization other than COVID-19. In cases requiring urgent hospitalization, COVID-19 is first eliminated by patient history and clinical and radiological findings. The nasopharyngeal swabs of the patients are taken either at the time of administrations or after hospitalization, and the results are obtained later.

This study focuses on patients, transferred from the emergency room to be hospitalized for non-COVID-19 diseases, and later who were diagnosed with COVID-19. A nosocomial transmission is highly suspected and results of these inectionsare examined. It was determined that nosocomial transmission originated from these patients and its clinical results were evaluated.

Materials and Methods

Patients hospitalized at the pulmonology inpatient clinic for examination and treatment of non-COVID-19 diseases

during the first wave of COVID-19 pandemic were included in this cross-sectional retrospective study. The clinical information and data for the patients were reviewed retrospectively. These patients stayed in single or two beded rooms (separated by curtains) and shared the same bathroom and toilet.

Of the 46 patients hospitalised within this period two of them (having pulmonary embolism and thymoma) were not taken nasopharyngeal swabs thus excluded from the study. The Oro-nasopharyngeal swabs taken from the remaining 44 patients were placed in viral transport media, and tested for COVID-19 via RT-PCR. Routine blood tests (complete blood count, biochemistry, serology, and coagulation tests) were performed at the time of hospitalization and upon hospitalization chest radiographs and thorax computerized tomography (CT) scans were taken from all of the patients. The diagnosis of COVID-19 was made depending on positive SARS-CoV-2 PCR test results (17). Four patients whose RT-PCR tests were positive were referred to the services where the treatment and follow-up of COVID-19 patients were carried out. Remainder of the patients were followed up clinically, radiologically, and also with RT-PCR tests. Patients were continued to be followed up for a period of 30 days after their discharge from the hospital.

Definition of nosocomial infection: The cases, where the infection occurred at least 5 days after patients had been admitted to the hospital and confirmed via positive RT-PCR test results.

Definition of nosocomial COVİD-19 outbreak: It was defined as the detection of three or more COVID-19 cases likely connected to one another (18).

Ethical Approval

The study was approved by the Ethical Committee of University of Health Sciences Turkey, İstanbul Training and Research Hospital (ID: 2419) and the Ministry of Health of the Republic of Turkey (T14-49-25), and it was also conducted in accordance with the principles of the Declaration of Helsinki.

Statistical Analysis

Statistical analysis was performed using the SPSS 27.0 program. All categorical variables are shown as percentages. Variables are given as mean with standard deviation; continuous variables are shown as median and range. Student's t-test and chi-square tests were used to make comparisons between groups. A p-value <0.05 was accepted as significant.

Results

The mean age of the patients was 65.6±13.6 (31-93), and 36 (82%) of the patients were male and 8 (18%) were female. Of the 44 patients included in the study, 25 had malignancies (23 primary lung cancers, one lung metastasis spread from colorectal cancer, one mesothelioma), six had chronic obstructive pulmonary disease (COPD) exacerbations, four had aggravations of idiopathic pulmonary fibrosis (IPF), three had infected bronchiectasis, two had pulmonary embolism (PE) and four had other disorders and 31 (70%) of these patients had comorbidities of which 15 with multiple comorbidities. The most common comorbidity observed in 24 patients [hypertension 20, ischemic heart disease (IHD) 11, congestive heart failure 5), was cardiovascular system diseases, followed by COPD (7 patients), type 2 diabetes

Table 1. Demographic characteristics and comorbidities of patients

Characteristics	Number of patients (n=44)
Gender, n (%)	
Female	8 (19%)
Male	36 (81%)
Age	
Mean ± SD, (min-max)	65.6 ±13.6 (31-93)
Diagnosis, n (%)	
Cancer*	25 (56%)
COPD exacerbation	6 (13%)
Interstitial pulmonary fibrosis	4 (9%)
Pneumonia	2 (4%)
Bronchiectasis	3 (6%)
Other**	4 (9%)
Comorbidities, n (%)	
None	13 (29%)
Various	31 (71%)
Comorbidities by distribution, n (%)	
Hypertension	20 (45%)
Ischemic heart disease	11 (25%)
Congestive heart failure	5 (11%)
COPD	7 (15%)
DM	4 (9%)
Chronic renal failure	3 (6%)
Pulmonary embolism	2 (4%)
Cerebrovascular disease	2 (4%)

SD: Standard deviation, COPD: Chronic obstructive lung disease, DM, Diabetes mellitus, Cancer*, Metastatic lung cancer (1 patient), mesothelioma (1 patient); other**, benign tracheal stenosis (1 patient), tuberculosis (1 patient), heart failure (1 patient), pulmonary embolism (1 patient)

mellitus (DM) (4 patients), PE (2 patients), and previous cerebral vascular disease (2 patients)]. The demographic characteristics of the patients are shown in Table 1.

The clinical characteristics and length of stay of four patients who were RT-PCR positive for COVID-19 at the time of admission were examined. Also, thorax CT scans of the patients were reviewed retrospectively. Due to radiological abnormalities related to patients' primary diseases, lesions suggestive of a suspected COVID-19 infection were easily omissible (19).

The clinical characteristics, radiological findings, length of stay, physical conditions, and outcomes of the patients who were COVID-19 positive were summarized below (Figure 1).

Case 1: A 69-year-old male patient was hospitalized with the diagnosis of lobar pneumonia. He also had DM, IHD, and COPD. Complaints of progressive dyspnea, cough, and sputum production were present. His thorax CT scan revealed, consolidation in the right lower lobe. He stayed in a single room for 48 hours, used a shared toilet, then was transferred to the COVID service when RT-PCR was positive, and discharged after recovery.

Case 2: An 81-year-old male patient with IHD was hospitalized with shortness of breath and hypoxia. Bilateral pleural effusion and ground-glass appearance in the base of the lungs were observed in his thorax CT scan. Transudate pleural fluid was taken by a thoracentesis. Like Case 1, he stayed in a single room for 48 hours, used a shared toilet, transferred to the COVID-19 service when RT-PCR was positive, and discharged after recovery.

Case 3: A 75-year-old male patient having IHD and COPD, diagnosed with squamous cell lung cancer a year ago presenting with blood-tinged sputum, showing signs of weakness, and deterioration of general condition was hospitalized. On thorax CT, there was a mass appearance of lung cancer on the right, which was also present in the previous CT scan, and newly emerged peripheral ground glass images on the left. The patient stayed in a double room for 48 hours with another patient and shared a toilet. Then he was followed in the COVID-19 service, recovered, and discharged.

Case 4: A 75-year-old female patient was hospitalized due to worsening dyspnea and respiratory failure. She was diagnosed with non-specific interstitial pneumonia three years ago and was still using corticosteroids 20 mg/day and long-term oxygen therapy. During the hospitalization period, thorax CT scan showed a progression of a bilateral infiltration compared to the CT scan of two months before, and new ground-glass appearances emerged on the left as well. She stayed in a double room for 48 hours in the service and used shared toilets. The patient was transferred to the COVID-19 service and then transferred to the intensive care unit 5 days later, and then died after three days.

Sixteen (40%) of the remaining 40 patients in the clinic were found to be RT-PCR (+) after an average of 8.2 (6-13) days. Comparison of laboratory results of the patients who developed and did not develop COVID-19 showed no statistical difference (Table 2).

Four index cases (Group 1), 16 nosocomial COVID-19 patients (Group 2), and 24 non-infected patients (Group 3) were followed during hospitalization and in the first month after discharge. One of the index cases died in the intensive care unit (Case 4). Nine of the 16 patients with nosocomial COVID-19 died in hospital and one within 1 month after discharge. Of the 24 patients who were not infected with COVID-19, five died during hospitalization, and seven

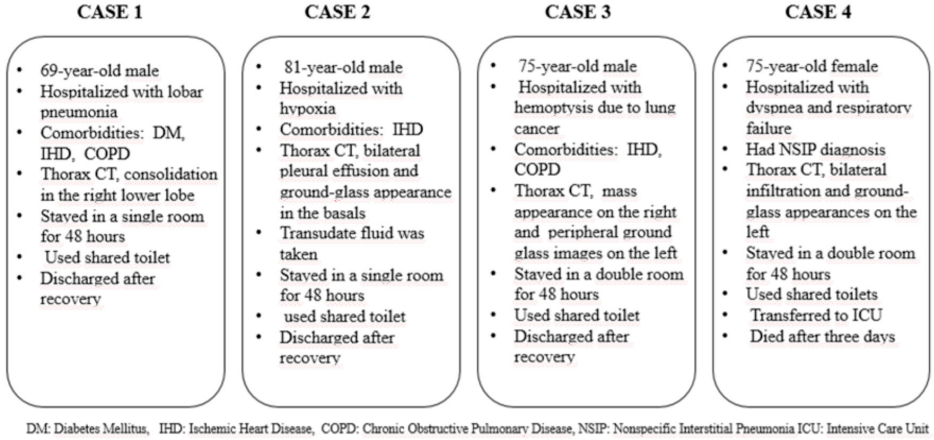

Figure 1. Clinical characteristic features of four index cases

died within one month after discharge probably due to their underlying primary diseases (Table 3). Mortality was observed to be as 25% (one case) in index cases, 21% (five cases) in non-infected, and 56% (nine cases) in nosocomial COVID-19 cases. A significant relationship was found between CVD/DM and mortality in patients with and without nosocomial COVID-19 infection (p=0.023, p=0.037, p<0.05, respectively) (Table 4).

Table 2. Comparison of demographic characteristics and laboratory results of the patients

	Normal values	Hospitalized COVID-19 (n=4)	Nosocomial COVID-19 (n=16)	Non-infected (n=24)	p
WBC x10^9	4-10	13.0±9.1	10.9±4.7	13.4±5.7	0.151
RBC x10^9	3.6-5.5	4.6±0.6	3.9±0.6	4.3±0.1	0.099
PLT count x10^9	150-450	336.3±271.9	297.3±102.9	285.1±148.1	0.776
Lymphocyte count x10^9	0.8-4	1.1±0.5	1.2±0.6	1.5±1	0.358
Lymphocyte %	10-50	11.8±7.1	11.9±6.1	13.2±11.6	0.679
Fibrinogen, mg/dL	180-350	431.7±39.1	524.4±238.8	468.7±194.1	0.862
Ferritin, ng/dL	23.9-336.2	393.0±258.3	462.9±433.2	350.7±411.5	0.779
D-dimer, mg/dL	0-0.60	2.0±3.1	2.3±1.9	5.2±9.4	0.438
LDH, U/L	<247	305.5±74.9	347.2±151.2	431.5±238.8	0.438
CRP, mg/L	0-5	140.2±112.7	107±75.9	102.7±97.0	0.882
ESR, mm/h	0-30	81.7±44.1	85.7±47.3	64.5±36.8	0.202
Procalcitonin, ng/mL	<0.5	0.1±0.02	0.7±1.02	0.3±0.3	0.091
Age		75±4.89	66.8±12.3	63.3±12.3	0.423
Gender F/M		1/3	1/15	6/18	0.114

COVID-19: Coronavirus disease-2019, WBC: White blood cell, RBC: Red blood cell, PLT: Platelet, LDH: Lactate dehydrogenase, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate

Table 3. Comparison of death rates by groups

	Group 1 hospitalized COVID-19 (index cases) (n=4)	Group 2 nosocomial COVID-19 (n=16)	Group 3 non-infected (n=24)	Overall (n=44)
Alive, n (%)	3 (75%)	6 (37%)	12 (50%)	21 (47.7%)
Death in hospital, n (%)	1 (25%)	9 (56%)	5 (21%)	15 (34.1%)
Death in the first month, n (%)	0 (0%)	1 (6%)	7 (29%)	8 (18.2%)

COVID-19: Coronavirus disease-2019

Table 4. Comparison of mortality by comorbidities in deceased patients during hospitalization

n (%)	Nosocomial COVID-19 n=16		Non-infected n=24		p value
	Died n (%)	Alive n (%)	Died n (%)	Alive n (%)	
Comorbidities	6 (66.7)	5 (71.4)	5 (100)	10 (52.9)	0.076
Cardiovascular disease	6 (66.7)	4 (57.1)	5 (100)	6 (31.6)	**0.023**
COPD	2 (22.2)	1 (14.3)	1 (20)	3 (15.8)	0.122
DM	2 (22.2)	0 (0)	1 (20)	0 (0)	**0.037**
Cerebrovascular disease	0 (0)	0 (0)	1 (20)	1 (5.3)	0.122
PE	0 (0)	1 (14.3)	1 (20)	1 (5.3)	0.224
CRF	0 (0)	1 (14.3)	1 (20)	1 (5.3)	0.224

COVID-19: Coronavirus disease-2019, COPD: Chronic obstructive pulmonary disease, DM: Diabetes mellitus, PE: Pulmonary embolism, CRF: Chronic renal failure. *p<0.05. Bold indicates statistical significance

Discussion

COVID-19 pandemic showed vulnerabilities and the importance of response capacity for preventing avoidable losses and quickly spiraling costs. Hospitalized patients constitute the most vulnerable group of patients due to the environment's proneness to infection and lack of adequate, established measures during the start of any epidemic (14,20). Our study therefore serves to guide the management of hospitalizations during periods of high levels of contingencies and unknowns. Both loss of life and public costs of health crisis could be controlled better by taking adequate measures and precautions at the very beginning of an epidemic/pandemic. Similar to previous studies, our study reveals that screening of the pandemic is crucial since nosocomial COVID-19 infection is highly contagious and mortal in patients with underlying disease who are hospitalized for non-COVID-19 disease (15,21).

Nosocomial COVID-19 infection directly affects patients' life quality and is reflected in the costs of hospitals as an extra burden. It has been shown that COVID-19 is transmitted through close, unprotected contact with infected patients. Moreover, current preventive and containment measures tend to overlook asymptomatic individuals and super spreaders whose nasopharyngeal swabs were not taken because they were not thought to be sick (10).

Moreover, COVID-19 patients exhibiting atypical clinical features such as gastrointestinal symptoms and fever were misclassified and hospitalized in non-COVID-19 clinics where different infection control protocols are applied. This situation was reported to lead to the spread of nosocomial COVID-19 (13,22). In our study, the clinical and radiological findings of 4 cases were hidden or masked the findings of COVID-19. These 4 index cases caused the nosocomial spread of COVID-19 and resulted in a mortality rate of 63% among infected patients.

Read et al. (22) drew attention to nosocomial COVID-19 infection in the first wave of the pandemic in England. They stated that there was a significant heterogeneity in nosocomial infection rates regarding the services provided by hospitals. The nosocomial infection rate was 9.7% in hospitals providing emergency and general care, whereas it was reported as 61.9-67.5% in community care hospitals and mental health hospitals (22). The rate of nosocomial infections in our clinic almost as high as that seen in nursing homes, led to the review of in-service infection control measures. Rooms were reallocated to serve for single occupancy. Visits of the patient's relatives were restricted. Limits were also put on the mobilization of the patients within the service area. Daily training was conducted on mask use and hand hygiene, and inspections were carried out to assure compliance. Afterward, no in-service contamination was observed. Another research reported that out of 662 inpatients with COVID-19, 45 (6.8%) were likely to have nosocomial COVID-19 and forty (88.9%) of them had previously shared a ward with a confirmed COVID-19 case (11).

COVID-19 is transmitted rapidly from person to person and the incubation period is relatively short. Average incubation period was found to be 4.5 days and the time to onset of disease symptoms was determined to be 5.2+3.2 days in 35 healthcare workers and their family members studied due to a hospital pandemic in Wuhan (23). In the meantime, recently published a meta-analysis of 142 studies involving 8.112 patients reported that the pooled incubation period was 6.57 days and ranged from 1.80 to 18.87 days (24). COVID-19 can be transmitted rapidly from person to person, even in asymptomatic situations, both in the hospital environment and in social activities. Practical measures, including public health services, isolation of cases, monitoring of close contacts, and containment of severe outbreak areas, may stop the spread (9,23).

Hospitalized patients upon health problems are usually older, have comorbidities, and are more susceptible and vulnerable to COVID-19 infection (15). In a cohort study relating to susceptible patients reported that one dayin the same ward with another patient with hospital-acquired COVID-19 was associated with an additional eight infections per 1.000 susceptible patients per day (25).

At the beginning of the pandemic, doctors working in hospitals that provided the National Health Service in England drew attention to the risk of nosocomial infection (25). They emphasized that this infection could lead to death, especially in the sensitive patient group. They recommended that some measures be taken such as separating patients, social distancing, accelerating the process of obtaining test results, and creating different areas based on swab results (26). Moreover there are suggestions for designing non-COVID services (27,28). It is essential that sufficient personal protective equipment is used and strict hand hygiene protocols are implemented (29).

It was reported that COVID-19 showed rapid nosocomial spread in the French geriatric unit, the infection rate was 20%, and the mortality rate was 28.6% in a 24-bed ward. They underlined the strict implementation of infection control

guidelines in geriatric units where the risk of morbidity and mortality is high (14). In the multicenter nosocomial COVID-19 study of COPE (COVID-19 in older people) from England and Italy, the mortality rate was reported as 27.0%. The average age of the patients was seventy-four. Older age, high CRP levels, impaired kidney function, coronary artery disease, and high clinical frailty were identified as risk factors for mortality (21).

In their study from Canada, which covers a similar period, Elkrief et al. (20) reported the incidence of nosocomial COVID-19 infection among patients with cancer and COVID-19 as 19%. The mortality rate due to COVID-19 in all cancer patients was 28%. Regarding the mode of transmission, the mortality rate was 47% in nosocomial COVID-19 patients and 24% in community-infected COVID-19 patients. Older age, poor Eastern Cooperative Oncology Group performance status, and another severe disease have been identified as independent risk factors for a short life span in patients with cancer and nosocomial COVID-19 (20,30).

In our study, the mortality rate of nosocomial COVID-19 cases was higher than the studies mentioned above. It was found that mortality was linked with the CVD/DM in patients with and without nosocomial COVID-19 infection as reported previously in the literature (13,21).

During the first wave, when the health system got blocked almost all over the world, only patients with serious illnesses requiring hospital care were admitted to the hospital. The mortality rate during hospitalization and 30-day follow-up was 50% in the non-COVID-19 patient group, indicating an undesirable delay in accessing health services for those with non-COVID-19 disease. In the early phase of the pandemic, false-negative rates of up to 33% have been reported for RT-PCT tests (31). The failure to diagnose COVID-19 in some patients in this group may also have contributed to this high rate.

Study Limitations

The limitations of our study are the failure to monitor the chain of infection and traceability of infectivity due to the lack of complete genomic sequences of coronavirus strains; the failure to test the nasopharyngeal swab of the patients' family members and contacts during hospitalization. However, this study is important to draw attention to making the necessary arrangements in the health system for the treatment and care of this patient group these days, when we cannot predict the future of the pandemic. It would not be wrong to predict that humanity will face similar or different infectious diseases such as COVID-19 in the future.

Conclusion

We conclude that, nosocomial COVID-19 in hospitalized patients is associated with high mortality. Taking all the deaths into consideration, the devastating effect of the pandemic on the elderly and patients with comorbidities is obviously remarkable. Therefore, utmost attention should be paid to the prevention of nosocomial infections.

Ethics

Ethics Committee Approval: The study was approved by the Scientific Board of University of Health Sciences Turkey, İstanbul Training and Research Hospital (ID: 2419) and the Ministry of Health of the Republic of Turkey (T14-49-25).

Informed Consent: Cross-sectional retrospective study.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: M.G.O., Design: M.G.O., Data Collection or Processing: M.G.O., B.A.B., S.T.O., T.Ö., F.T.A., E.S.A.K., I.K.A., Analysis or Interpretation: M.G.O., B.A.B., S.T.O., T.Ö., F.T.A., E.S.A.K., I.K.A., Literature Search: M.G.O., Writing: M.G.O.

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