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Research Article

Title: 30-day readmission rate of COVID-19 patients discharged from a tertiary care university hospital in Turkey; an observational, single-center study

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Running Title: COVID-19 & 30-day readmission

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30-day readmission rate of COVID-19 patients discharged from a tertiary care university hospital in Turkey; an observational, single-center study

Abstract

Background: The 30-day readmission rate is an important indicator of patient safety and hospital's quality performance. In this study, we aimed to find out the 30-day readmission rate of mild and moderate severity COVID-19 patients discharged from a tertiary care university hospital and to demonstrate the possible factors associated with readmission.

Methods: This is an observational, single-center study. Epidemiological and clinical data of patients who were hospitalized with a diagnosis of COVID-19 were retrieved from a research database where patient information was recorded prospectively. Readmission data was sought from the hospital information management system and National Health Record System to detect if the patients were readmitted to any hospital within 30 days of discharge. Adult patients (≥ 18 years-old) hospitalized in COVID-19 wards with a diagnosis of mild or moderate COVID-19 between March 20, 2020 (when the first case was admitted to our hospital), and April 26, 2020 were included.

Results: From March 26 to May 1, there were 154 mild or moderate severity (non-critical) COVID-19 patients discharged from COVID-19 wards, of which 11 (7.1%) were readmitted. The median time of readmission was 8.1 days (IQR=5.2). Two patients (18.1%) were categorized to have mild disease and the remaining 9 (81.9%) as moderate disease. Two patients who were over 65 years of age and had metastatic cancers and hypertension developed sepsis and died in the hospital during the readmission episode. Malignancy (18.7% vs 2.1%, $P = 0.04$) and hypertension (45.5% vs 14%, $P = 0.02$) were more common in those who were readmitted.

Conclusions: This is one of the first studies to report on 30-day readmission rate of COVID-19 in the literature. More comprehensive studies are needed to reveal the causes and predictors of COVID-19 readmissions.

Key words: Readmission, 30-day readmission rate, COVID-19

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Introduction

In December 2019, a new ‘Coronavirus’ was identified in investigations on unknown origin viral pneumonia cases in China. The virus was named “SARS-CoV-2” because of its similarity to the SARS (Severe Acute Respiratory Syndrome) virus (1). The disease spread rapidly all over the world and was declared as a pandemic by the World Health Organization (WHO) in March 2020 (2). As of 9 September 2020, novel coronavirus disease 2019 (COVID-19) has infected over 27 million people globally and approximately 285,000 people in Turkey (3,4).

Published data covers mostly information on the clinical features, laboratory findings and treatment of patients hospitalized with the diagnosis of COVID-19, however many of the COVID-19 patients were discharged with quarantine suggestions, and treatment at home. There is limited data on whether these patients have fully recovered or if they were readmitted. The readmission data of COVID-19 patients are scarce (5-7).

The 30-day readmission rate is an important indicator of patient safety and hospital’s quality performance. The ‘30-day readmission’ is defined as ‘unplanned admission for any cause to an acute care hospital within 30 days of discharge’ (8). Most studies have suggested that better quality of inpatient care is associated with a lower risk of readmission (9,10). Several studies have investigated hospital readmissions in general patient populations or among specific populations including older adults and patients with chronic conditions (such as congestive heart failure, hypertension, chronic obstructive lung disease) (11,12).

In this study, we aimed to find out the 30-day readmission rate of mild and moderate severity COVID-19 patients discharged from a tertiary care university hospital. Secondly, we aimed to demonstrate the characteristics and outcomes of patients who were readmitted.

1. Methods:

1.1 Study Design and Population:

This observational, single-center study was conducted in a tertiary care university hospital. Epidemiological and clinical data of patients who were hospitalized with a diagnosis of COVID-19 were retrieved from a research database where patient information was recorded prospectively. Readmission data was sought from the hospital information management system and National Health Record System (e-Pulse) to detect if the patients were readmitted to any hospital within 30 days of discharge. e-Pulse is a centralized hospital management information system owned by the Ministry of Health, which retrieves and integrates data from all of the healthcare institutions and makes them available for the patient and his/her healthcare providers. Patients and doctors (with the consent/ approval of the patient) can access the healthcare data including all admissions, laboratory results, medical images, prescription and medication details, emergency information, diagnosis details, reports and health records that contains all the details concerning the examinations via desktop and mobile platforms (13). Each patient has a unique identity number, which is the national identity number, enabling tracking of his/her records in the healthcare system by healthcare providers given the patient has consented at the registration stage. Hence, the healthcare information of the patients in the e-Pulse system is reliable, complete and accessible except for those who haven't consented for data sharing. We retrieved the data of the patients who have consented for accessibility of their data through the e-pulse system. 30-day readmission was defined as an unplanned admission to the hospital within 30 days of discharge.

Adult patients (≥ 18 years-old) hospitalized in COVID-19 wards with a diagnosis of COVID-19 between March 20, 2020 (when the first case was admitted to our hospital), and April 26, 2020 were included. Among the patients who were included in the study, the first patient was discharged on March 26, and the last patient was discharged on May 01.

Critically-ill patients with sepsis and/or acute respiratory distress syndrome requiring intensive care unit (ICU) at the time of admission or those who were transferred to the ICU during the hospital stay or those who were transferred from the ICU to the COVID-19 wards were excluded considering that critically ill patients with COVID-19 might have different disease courses due to comorbidities and disease states other than COVID-19 and their mortality rate is higher than the mild and moderate cases (14).

Diagnosis, hospitalization, treatment and discharge decisions were made by attending physicians according to the current national guidelines prepared by the Scientific Advisory Committee of the Turkish Ministry of Health. Patients who need admission to the COVID-19 wards were categorized as “probable” or “confirmed” cases. “Confirmed case” was defined as a patient who had positive polymerase chain reaction (PCR) test result for *SARS-CoV-2*. “Probable case” was defined as a patient who had sudden onset of fever, cough or dyspnea without nasal discharge, with or without travel history, or who had contact with COVID-19 infected individual in the last 14 days or patients who had severe acute respiratory infections that cannot be explained with any other cause, but with negative PCR test result for *SARS-CoV-2* (15).

All the patients underwent bacterial and viral multiplex PCR testing (covering 14 different respiratory pathogens including influenza virus) with nasopharyngeal swabs ruling out other possible infections and coinfections at the time of admission. Examinations and tests were done thoroughly for signs of organ failure, acute exacerbation of chronic disease or for other reasons that might have caused the acute admission other than SARS-CoV-2 infection. “Probable cases” were the cases that can only be explained by SARS-CoV-2 infection with their clinical characteristics and laboratory findings.

COVID-19 cases were further classified into three categories with regards to WHO classification as mild, moderate, and severe disease. (16).

Treatment regimens for COVID-19 and duration of treatment were also recorded. Main categories of treatment regimens were: hydroxychloroquine(HCQ) only, HCQ+azithromycin (AZT), and favipravir (FAV) containing regimens. Some patients could also have received oseltamivir (OTV) or empirical antibacterial treatment as per the indication. Even if the patients were discharged before the treatment was completed, their medications were provided, and treatments were completed at home.

As this was an observational study, the follow-up and discharge decisions of the patients were not intervened. All patients were discharged following the instructions in the national guideline stating that "COVID-19 patients under inpatient treatment and monitoring who have not had any fever and need for oxygen within the last 48-72 hours and who fulfil the criteria for home monitoring may be discharged after their treatment is determined by the consultant physician. Their home isolation may be terminated on the 14th day, following the date of discharge provided not to manifest any symptoms or fever" (15).

The study protocol was approved by the Institutional Ethics Board (Approval number: GO 20/353) and carried out in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki as revised in 2000.

2.2 Statistical Analysis

All statistical analyses were performed with SPSS statistical software package (SPSS,IBM,Armonk,NY) version 25. In descriptive statistics, number and percentage were used for categorical variables. For continuous variables with normal distribution, mean and standard deviation(SD) were used; and for continuous variables that do not show normal distribution, interquartile range(IQR) was preferred. Pearson Chi-Square Test or Fisher exact test were used in the analysis of categorical variables. Non-normally distributed numerical

data were analyzed with Mann-Whitney U test or Kruskal Wallis Tests. For all comparisons *P*-values less than 0.05 were considered as statistically significant.

2. Results:

From March 26 to May 1, there were 154 mild or moderate severity (non-critical) COVID-19 patients discharged from COVID-19 wards, of which 11 (7.1%) were readmitted (Table 1). While 98(63.6%) patients had a positive *SARS-CoV-2* PCR test result (confirmed case), the rest of the patients had either compatible CT imaging results or clinical characteristics those were highly suspicious of COVID-19 (probable). Disease category (confirmed or probable) or severity (mild or moderate) were not associated with readmission. The median length of stay (LoS) during the initial admission was 4 days (IQR=5) and was 3 days (IQR=3) among readmitted patients with no statistical difference. All but five patients (96.8%) received HCQ or HCQ based combination therapies. The characteristics of those patients who were readmitted within 30 days (n=11) and who were not (n=143) were compared in Table 1.

All of the patients met the discharge criteria mentioned in the methods section. Nine patients had completed their first treatment course at the hospital (4 patients, 36.3%) or at home (5 patients, 45.5%) before the readmission. The median duration from discharge until readmission was 8.1(IQR=5.2) days. Two patients (18.1%) were categorized as mild disease and the remaining 9(81.9%) as moderate. Malignancy (18.7% vs 2.1%, $P = 0.04$) and hypertension (45.5% vs 14%, $P = 0.02$) were more common in those who were readmitted.

General characteristics of 11 readmitted patients are given in Table 2.

The main reasons for readmission were prolonged fever (45.5%) and persistent cough (45.5%) (Table 2). Only one patient had no complaints but was admitted due to social problems jeopardizing home isolation (Table 2, Patient 5). Among the readmitted patients,

two did not receive any treatment during the initial admission period (Table 2). One of the two patients who received no treatment in the initial admission period developed fever and radiological signs of pneumonia, and HCQ+AZT were initiated (Table 2, Patient 8). The other patient who did not receive treatment in the initial admission period was a 43-year old male patient and he was readmitted due to social problems preventing the execution of the home isolation protocol (Table 2, Patient 5). Isolation problems at home were solved and he was discharged again after 3 days.

The other patients (n=9) were treated with HCQ+AZT 5 days. Only one patient received FAV as a part of the initial treatment regimen and although this patient was readmitted with dyspnea, there was regression of pneumonia on the chest CT and the patient received no further treatment (Table 2, Patient 9). On the other hand, progression in pneumonia was detected in the CT scan of four patients who presented with either cough or fever or both (Figure 1). These patients who were treated with HCQ+AZT or HCQ+AZT+OTV during the initial admission were started FAV during the second admission (Table 2, Patients 1,2,6,10).

All but two patients were discharged again. However, two patients who were over 65 years of age and had metastatic cancers developed sepsis and died in the hospital during the readmission episode. The first patient was a 67-year old female patient with a history of metastatic lung adenocancer, hypertension and chronic kidney disease presented with cough and fever (Table 2, Patient 7). Chest CT showed subpleural, multifocal nodular ground-glass opacities which were compatible with COVID-19 pneumonia in the lower lung lobes (Figure 2). Her complete blood count revealed leukocytosis, neutrophilia and lymphocytopenia. Treatment was planned as HCQ+AZT for COVID-19 pneumonia and ceftriaxone since bacterial pneumonia could not be excluded. On the 5th day of hospitalization she developed acute kidney injury. Intravenous hydration with isotonic saline was planned, but the patient

and the family rejected the treatment inspite of the acknowledgement on the risk of progression to acute renal failure. After 6 days of hospital stay, the patient was discharged at the discretion of herself and her family with a declaration to increase the volume of oral hydration. Next day, patient was back to hospital with confusion, her serum creatinine level was 3.95 mg/dl and she was hypotensive. Intravenous meropenem and hydration was started with a diagnosis of clinical sepsis, however, she had cardiac arrest and died.

The second deceased patient was a 75-year old male patient with the history of metastatic colon cancer (lung metastasis), hypertension and benign prostate hyperplasia (Table 2, Patient 11). He had no symptoms and underwent thoraco-abdominal CT for cancer evaluation in the outpatient clinic for his routine oncology follow-up. Thorax CT showed a subsegmental ground-glass opacity that was suspicious for COVID-19 pneumonia on the left upper lobe. He received HCQ+AZT and cefuroxime. The patient was discharged on the 9th day of admission. After 14 days, he was readmitted with swelling on the legs and dyspnea. Chest CT showed pleural and pericardial effusion but no signs of any infection or pulmonary thromboembolism. He received diuretics and noninvasive mechanical ventilation for pulmonary edema. Extended-spectrum antibiotics were started considering clinical sepsis. However, the patient died because of septic shock and respiratory failure on the 11th day.

3. Discussion:

To the best of our knowledge this is one of the first studies exploring 30 day readmission rate of COVID-19 patients. The 30-day readmission was defined as unplanned admission to the hospital within 30 days of discharge. Patients may have had an unplanned readmission for any reason. Unplanned hospital readmissions, especially avoidable unplanned readmissions, are accepted as an indicator of quality of care and a hospital performance measure (17). Healthcare systems around the world are building up intentions to deliver

higher quality care. Reducing preventable hospital admissions has drawn policy attention as an opportunity to improve the quality of care and reduce healthcare costs in several countries, including the United States(US), England, Denmark, and Germany (18). In the US, the Centers for Medicare and Medicaid Services (CMS) began publicly reporting 30-day readmission rates for heart failure(HF), acute myocardial infarction(AMI), and pneumonia as a measure of hospital performance in 2009 after these measures were endorsed by the National Quality Forum (19). In an analysis in US from 2007 to 2009, the readmission rates of HF, AMI and pneumonia were 35.2%, 10.0% and 22.4%, respectively (20). On the other hand, 30-day readmission rate was reported as 25.1% after 219,532 hospitalizations for HF in Australia and New Zealand (21). 30-day readmission rate is a quality metric that we commonly use for other disease conditions and measures to prevent readmission are usually well defined in those diseases. Here, we aimed to open a window to the 'quality management' in COVID-19 while trying to outline readmissions are possible and common, and when we better get to know the disease and management algorithms are clear and applicable we can measure the quality of the care we deliver in terms of 30-day readmission. Additionally, readmission should be perceived as a threat to the sustainability and continuity of healthcare in an already overwhelmed healthcare system.

The 30-day readmission rate in this cohort of patient with mild to moderate COVID-19 was 7.1%. In the early stages of the pandemic, in a prospective cohort study evaluating clinical features and outcomes of discharged COVID-19 patients, 5 of 131 (3.8%) were readmitted in the first and the second week after discharge and 3 (2.29%) were readmitted in the third and the fourth week after discharge. Although not stated in the study, we calculated the 30-day readmission rate as 6.1% (22). In a study from Spain, 61 (4.4%) of 1368 patients with laboratory confirmed *SARS-CoV-2* were readmitted (23). In a recent study, of 2864 discharged patients, 103 (3.6%) had returned for emergency care after a median of 4.5 days,

with 56 had requiring inpatient readmission (24). Readmission rate is not much different from more comprehensive and multicenter studies in the recent literature. However, as expected from the small sample of our study, the 95% confidence interval for the 7.1% readmission rate is wide. In addition, the comparison of the 30-day readmission rates between COVID-19 and that for other conditions in our hospital could be informative. For instance; the frequency of emergency department (ED) visits of 1570 patients discharged from the internal medicine wards were 1.3% within 7 days and were 5.2% within 30 days (12).

The median LoS of the study population was 4(IQR=1-28) days in the initial admission and 3(IQR=1-25) days among the readmitted patients. This value can change between institutions depending on the capacity of hospital beds in that particular institution as well as the treatment strategies and home isolation policy of the country. In a systemic review and data synthesis, median hospital LoS ranged from 4 to 53 days within China and 4 to 21 days outside of China. A median hospital LoS was 14(IQR=10-19) days for China, compared with 5(IQR=3-9) days outside of China (25). Several studies have been published assessing the relationship between LoS and readmission rates for different disease in the pre-pandemic periods (26-29). Shorter hospital LoS for HF was associated with increased rates of cardiovascular and HF readmissions but lower rates of non-cardiovascular readmissions (30). In a nation-wide study of Norwegian Hospitals, being admitted to a hospital with relatively short average LoS increased the patient's risk of early readmission significantly (31). The results also indicated that there exists a link between the basic conditions at which the hospitals deliver the care, and the outcome of the patients measured as early readmissions. Somani et al. reported that COVID-19 patients who were readmitted had a shorter median LoS during index hospitalization (4.5 [2.9,9.1] vs 6.7 [3.5, 11.5] days; P=0.006) (24). Parra et al. also reported that readmitted COVID-19 patients had a shorter LoS (6 [4-14] vs 9 [6-14] days; P=0.02) (23). LoS seems not to be the primary measure of interest in COVID-19 studies

which report it, however, it can be an important parameter and can sure be related to unplanned readmissions. Hospital LoS of COVID-19 patients can be affected by many situations such as hospital bed capacity, treatment plans, quality of care and should also be an important issue that needs to be analyzed. It should be noted that the demand for hospital admissions and the learning curve of the disease has changed over the course of the epidemic, which may have had a varying impact on patient discharge.

There was a higher prevalence of readmission in hypertensive patients ($p=0.02$). Similarly, the percentage of patients with an accompanying malignancy were at increased risk for readmission (18.2% vs 2.1%, $p=0.04$). In the study from Spain, immunocompromised patients were at increased risk for readmission and there was also a trend towards a higher probability of readmission in hypertensive patients (23). A retrospective cohort study from USA reported higher proportions of COPD (6.8% vs 2.9%) and hypertension (36% vs 22.1%) among readmitted patients compared to not readmitted patients (24). Current data indicate HT as a risk factor for poor prognosis in COVID-19 patients (32, 33) which may be related to the increase in readmission rates. In a nationwide analysis in China, patients with cancer were found to have a higher risk of COVID-19 than individuals without cancer and malignancy has been reported as a poor prognostic factor in COVID-19 (34). In the present study the patients who died in the readmission period were elderly patients who had both metastatic cancers, HT and developed sepsis. Both of these patients had negative PCR test results but had CT scans compatible with COVID-19 pneumonia. Chest CT has found to have low rate of missed diagnosis of COVID-19 (3.9%, 2/51) and may be useful as a standard method for the rapid diagnosis of COVID-19 to optimize the management of patients (35,36,37). However, diagnosis of COVID-19 on clinical grounds can be challenging in complex patients with multiple morbidities.

It might be argued that patients with such prognostic factors could have received FAV in the initial admission. FAV is considered as one of the potential candidates for COVID-19 treatment and used in many countries. Although, there are also several randomized controlled trials going on in China, there is not solid evidence to show in which patient group it will be used as a priority (38).

Discussing readmission in COVID-19 is challenging, as we yet do not know the clinical characteristics of the disease and we do not have established treatment regimens and care bundles. Hence, it's difficult to analyze and discuss the factors contributing to the occurrence of readmission. Is it because of quality gaps or failed transitional care interventions in this patient population, or is it related to the natural course of the disease that may wax and wane? For instance, one patient who did not receive any treatment in the initial admission period developed fever and radiological signs of pneumonia after 9 days of home isolation, after which HCQ+AZT was initiated in the readmission period. It's hard to judge whether this readmission was due to undertreatment or short observation period of initial admission or was as a result of the natural course of the disease itself. On the other hand, four of the eleven patients were readmitted with the radiological progression of existing pneumonia without demand-for-oxygen supplementation although these patients received HCQ+AZT during the initial admission period. Lack of evidence-based therapies prevents the determination of the quality gap.

Our study has some limitations. Many features such as individual characteristics of patients, current diseases, clinical presentations, laboratory findings, and the treatments can cause readmission. We did not perform multivariable analysis to explain the causes statistically. The sample size was not enough to evaluate the predictors of hospital readmissions. We give only our observations amidst a stressful pandemic situation that we have not yet fully understood the dynamics of the disease.

In conclusion, this is one of the first studies to report on 30-day readmission rate of COVID-19 in literature. Prolonged fever and persistent cough were the most common complaints on readmission. The percentage of patients with accompanying hypertension and malignancy were higher among readmitted patients. Two patients who died on the second admission had metastatic cancer and HT. More comprehensive studies are needed to reveal the causes and predictors of COVID-19 readmissions and to clearly demonstrate whether 30-day readmission rate can be used as a quality indicator of COVID-19 care.

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Disclaimer: This study has not been presented or published in a conference, or published in an abstract book or any other relevant information. This study is not part of a PhD thesis.

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Data availability statement: The data underlying this article cannot be shared publicly due to the privacy of individuals that participated in the study and our data was sought from the hospital information management system and National Health Record System. The data will be shared on reasonable request to the corresponding author.

References:

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The lancet*. 2020;395(10223):497-506.
2. Organization WH. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). 2020.
3. World Health Organization (WHO). WHO Coronavirus Disease (COVID-19) Dashboard. Data last updated: 2020/9/9, 3:36pm CEST. Available from: <https://covid19.who.int>.
4. Republic of Turkey, Ministry of Health. COVID-19 Information Page. Available from: <https://covid19.saglik.gov.tr/>.
5. Cao, Hong, et al. "The clinical characteristic of eight patients of COVID-19 with positive RT-PCR test after discharge." *Journal of Medical Virology* (2020).
6. Wang, Haizhou, et al. "Rehospitalization of a Recovered Coronavirus Disease 19 (COVID-19) Child With Positive Nucleic Acid Detection." *The Pediatric Infectious Disease Journal* 39.6 (2020): e69.
7. Wang, Xiaorong, et al. "Persistence of intestinal SARS-CoV-2 infection in patients with COVID-19 leads to re-admission after pneumonia resolved." *International Journal of Infectious Diseases* (2020).
8. CMS. Centers for Medicare & Medicaid Services. Last updated March 2017. Available: <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeedbackProgram/Downloads/2015-ACR-MIF.pdf>

9. Chung, Eugene S., et al. "Relationship of a quality measure composite to clinical outcomes for patients with heart failure." *American Journal of Medical Quality* 23.3 (2008): 168-175.
10. Shahian, David M., et al. "Association of National Hospital Quality Measure adherence with long-term mortality and readmissions." *BMJ quality & safety* 21.4 (2012):325-336.
11. Brennan, Jesse J., et al. "Inpatient readmissions and emergency department visits within 30 days of a hospital admission." *Western Journal of Emergency Medicine* 16.7 (2015): 1025.
12. Kaya, Sıdıka, et al. "Emergency department visits following discharge: Implications for healthcare management." *International Journal of Healthcare Management* (2020):1-9.
13. Turkish Republic Ministry of Health. E-pulse v.2.0. User Manual 2018. Available: https://enabiz.gov.tr/document/User_Manual.pdf
14. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA*. 2020;323(20):2052–2059.
15. Republic of Turkey, Ministry of Health. Directorate General of Public Health. COVID-19 (SARS-CoV-2-infection) Guide. Study of Scientific Board. Page 11. April 14th 2020, Ankara.
16. World Health Organization. Clinical Management of severe acute respiratory infection (SARI) when COVID-19 diseases is suspected. Interim Guidance, 13 March 2020.
17. van Walraven, Carl, Alison Jennings, and Alan J. Forster. "A meta-analysis of hospital 30-day avoidable readmission rates." *Journal of evaluation in clinical practice* 18.6 (2012): 1211-1218.

18. Kristensen, Søren Rud, Mickael Bech, and Wilm Quentin. "A roadmap for comparing readmission policies with application to Denmark, England, Germany and the United States." *Health policy* 119.3 (2015): 264-273.
19. DeVore, Adam D., et al. "Has public reporting of hospital readmission rates affected patient outcomes?: analysis of Medicare claims data." *Journal of the American College of Cardiology* 67.8 (2016): 963-972.
20. Dharmarajan, Kumar, et al. "Diagnoses and timing of 30-day readmissions after hospitalization for heart failure, acute myocardial infarction, or pneumonia." *Jama* 309.4 (2013): 355-363.
21. Labroschiano, C., et al. "Rates of 30-Day readmission and mortality after heart failure hospitalisation in Australia and New Zealand: A population study." *Heart, Lung and Circulation* 26 (2017): S145-S146.
22. Wang X, Xu H, Jiang H, et al. The Clinical Features and Outcomes of Discharged Coronavirus Disease 2019 Patients : A Prospective Cohort Study [published online ahead of print, 2020 May 22]. *QJM*. 2020;hcaa178. doi:10.1093/qjmed/hcaa178.
23. Parra, Lina Marcela, et al. "Hospital readmissions of discharged patients with COVID-19." *MedRxiv* (2020).
24. Somani, S.S., Richter, F., Fuster, V. et al. Characterization of Patients Who Return to Hospital Following Discharge from Hospitalization for COVID-19. *J GEN INTERN MED* (2020). <https://doi.org/10.1007/s11606-020-06120-6>
25. Rees, Eleanor M., et al. "COVID-19 length of hospital stay: a systematic review and data synthesis." (2020).
26. Chou F, Reome E, Davis P. Impact on length of stay and readmission rates when converting oral to long-acting injectable antipsychotics in schizophrenia or

- schizoaffective disorder. *Ment Health Clin.* 2016;6(5):254-259. Published 2016 Aug 31.
27. Eapen, Zubin J., et al. "Do countries or hospitals with longer hospital stays for acute heart failure have lower readmission rates? Findings from ASCEND-HF." *Circulation: Heart Failure* 6.4 (2013): 727-732.
28. Kumar, Vivek, Neha Chaudhary, and Maureen M. Achebe. "epidemiology and predictors of all-cause 30-Day readmission in patients with sickle cell crisis." *Scientific reports* 10.1 (2020): 1-10.
29. Garg, Sushil K., et al. "Incidence and Risk Factors Associated With 30-Day Readmission for Alcoholic Hepatitis." *Journal of clinical gastroenterology* 53.10 (2019): 759-764.
30. Sud, Maneesh, et al. "Associations between short or long length of stay and 30-day readmission and mortality in hospitalized patients with heart failure." *JACC: Heart Failure* 5.8 (2017): 578-588.
31. Heggstad T. Do hospital length of stay and staffing ratio affect elderly patients' risk of readmission? A nation-wide study of Norwegian hospitals. *Health Serv Res.* 2002;37(3):647-665.
32. Guan, Wei-jie, et al. "Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis." *European Respiratory Journal* 55.5 (2020).
33. Huang, Songjiang, et al. "COVID-19 patients with hypertension have more severe disease: a multicenter retrospective observational study." *Hypertension Research* (2020): 1-8.
34. Liang, Wenhua, et al. "Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China." *The Lancet Oncology* 21.3 (2020): 335-337.

35. Li Y, Xia L. Coronavirus Disease 2019 (COVID-19): Role of Chest CT in Diagnosis and Management. *AJR Am J Roentgenol.* 2020;214(6):1280-1286. doi:10.2214/AJR.20.22954.
36. Ai, Tao, et al. "Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases." *Radiology* (2020): 200642.
37. Long, Chunqin, et al. "Diagnosis of the Coronavirus disease (COVID-19): rRT-PCR or CT?." *European journal of radiology*(2020): 108961.
38. Wu R, Wang L, Kuo HD, et al. An Update on Current Therapeutic Drugs Treating COVID-19 [published online ahead of print, 2020 May 11]. *Curr Pharmacol Rep.* 2020;1-15. doi:10.1007/s40495-020-00216-7.

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Table 1: Baseline characteristics of the COVID-19 patients included in the study

	Total n = 154	No 30-day Readmission n = 143	30-day Readmission n = 11	P
Age, median (IQR), year	44.5 (24)	44 (25)	49 (25)	0.15
Sex, n (%)				0.75
Female	77 (50)	72 (50.3)	5 (45.5)	
Male	77 (50)	71 (49.7)	6 (54.5)	
Underlying medical illnesses, n (%)				
Diabetes mellitus	19 (12.3)	17 (11.9)	2 (18.2)	0.63
Hypertension	25 (16.2)	20 (14)	5 (45.5)	0.02
COPD/Asthma	13 (8.4)	13 (9.1)	0	N/A
CAD/CHF	7 (4.5)	7 (4.9)	0	N/A
Malignancy	5 (3.2)	3 (2.1)	2 (18.2)	0.04
Diagnosis, n (%)				0.20
Confirmed	95 (61.7)	90 (62.9)	5 (45.5)	
Probable	59 (38.3)	53 (37.1)	6 (54.5)	
Disease Severity, n (%)				1.0
Mild	31 (20.1)	29 (20.3)	2 (18.1)	
Moderate	123 (79.8)	114 (79.7)	9 (81.9)	
Treatments, n (%)				
No treatment	4 (2.6)	2 (1.4)	2 (18.2)	N/A
HCQ	21 (13.6)	21 (14.7)	0	N/A
HCQ + AZT	107 (69.5)	99 (69.2)	8 (72.1)	1.0
FAV (combined/sequential)	21 (13.6)	20 (13.9)	1 (9.1)	1.0
LPV/RTV	1 (0.6)	1 (0.7)	0	N/A
Length of stay on the first admission, median (IQR), days	4 (4)	4 (5)	3 (3)	0.48

COPD; Chronic Obstructive Pulmonary Disease, CAD; Coronary Artery Disease, CHF; Chronic Heart Failure
 HCQ; Hydroxychloroquine, AZT; Azithromycin, FVP; Favipravir, LPV/RTV; Lopinavir/ritonavir

Table 2. Characteristics and outcomes of the patients who were readmitted within 30 days after discharge

Patient	Sex	Age years	Comorbidity	Initial Admission						Readmission						Outcome	
				Symptoms	PCR Test Result	Chest CT	Severity Category	Treatment	Length of hospital stay, days	Days from discharge until readmission, days	Symptoms	PCR Test Result	Chest CT	Treatment	Rapid antibody test result		Length of hospital stay, days
1	F	50	-	Fever Cough Sore throat	+	Pneu*	Moderate	HCQ+AZT 5 days	2	6	Cough	N/A	Pneu* Progression	FVP	N/A	3	Recovered Discharged
2	M	67	Aortic aneurysm	Fever, Cough	+	Pneu*	Moderate	HCQ+AZT 5 days	3	5	Fever Cough	N/A	Pneu* Progression	FVP	N/A	5	Recovered Discharged
3	F	49	HT	Fever, Cough Fatigue Myalgia	+	Pneu*	Moderate	HCQ+AZT 5 days	5	12	Back pain	N/A	Normal	No treatment	N/A	1	Discharged
4	F	43	Arrhythmia	Fever, cough, sore throat, diarrhea	+	N	Moderate	HCQ+AZT 5 days	3	18	Fever Cough	-	Pneu*	No treatment	N/A	1	Discharged
5	M	43	FMF	Asymptomatic	+	N	Mild	No treatment	1	3	Asymptomatic	N/A	N/A	No treatment	N/A	3	Discharged
6	F	26	-	Fever Cough Myalgia	-	Pneu*	Moderate	HCQ+AZT +OTV 5 days	3	8	Fever Cough Myalgia	+	Pneu* Progression	FVP	+	6	Recovered Discharged
7	F	67	HT, CKD Metastatic lung adenocancer	Fever Cough Sputum	-	Pneu*	Moderate	HCQ+AZT 5 days +CRO,5 days	6	1	Confusion	N/A	N/A	Meropenem	N/A	1	Sepsis Cardiac Arrest Exitus
8	M	27	-	Cough Sore throat	-	N	Mild	No treatment	1	9	Fever Cough	-	Pneu*	HCQ+AZT	N/A	3	Recovered Discharged
9	M	75	T2DM, HT, BPH, Hypothyroidism	Fever Cough, Dyspnea	-	Pneu*	Moderate	HCQ+AZT +FVP, 5 days +Meropenem, 5 days	25	3	Dyspnea	N/A	Pneu* Improvement	No treatment	N/A	2	Recovered Discharged
10	M	48	T2DM, HT, OSAS	Fever Fatigue Myalgia.	-	Pneu*	Moderate	HCQ+AZT +OTV 5 days	3	11	Fever	-	Pneu* Progression	FVP MXF	+	2	Recovered Discharged
11	M	75	HT, BPH Metastatic colon ca	Asymptomatic	-	Pneu*	Moderate	HCQ+AZT 5 days +CXM,7 days	9	14	Dyspnea Leg swelling	N/A	N/A	-	N/A	11	Sepsis, Respiratory Failure, Exitus,

"*"; Consistent with covid-19 pneumonia, N; normal, "+"; Positive, "-"; negative, N/A; not applicable

HT; Hypertension, FMF; Familial Mediterranean Fever, CKD; Chronic Kidney Disease, T2DM; Type 2 Diabetes Mellitus, BPH; Benign Prostat Hyperplasia, OSAS; Obstructive Sleep Apnea Syndrome

HCQ; Hydroxychloroquine, AZT; Azithromycin, FVP; Favipiravir, OTV; Oseltamivir, CXM; Cefixim, MXF; Moxifloxacin

Figure Legends:

Figure 1: Progression in pneumonia on the readmission (**Table 2, Patient 2**)

1 - Chest CT on the initial admission: Unilateral and solitary ground glass opacity associated with early COVID-19 pneumonia in the right lung upper lobe anterior segment

2 – Chest CT on readmission: Widespread ground-glass opacities in both lungs

Figure 2: Chest CT on the first admission (**Table 2, Patient 7**)

1 - Fibroatelectatic changes to the right lung upper lobe, nodular ground-glass opacities mostly located in the lower lobe of the right lung compatible with COVID-19 pneumonia

2 - Multifocal ground-glass opacities in the left lung, upper lobe in lingula

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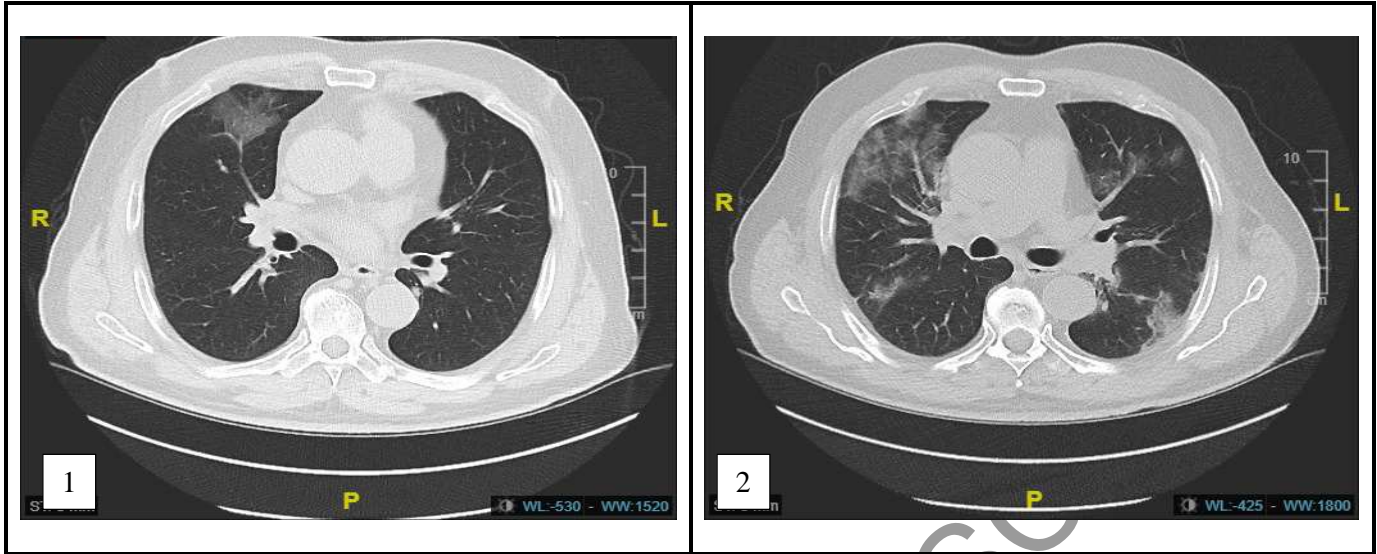


Figure 1: Progression in pneumonia on the readmission (Table 2, Patient 2)

1 - Chest CT on the initial admission: Unilateral and solitary ground glass opacity associated with early COVID-19 pneumonia in the right lung upper lobe anterior segment

2 - Chest CT on readmission: Widespread ground-glass opacities in both lungs

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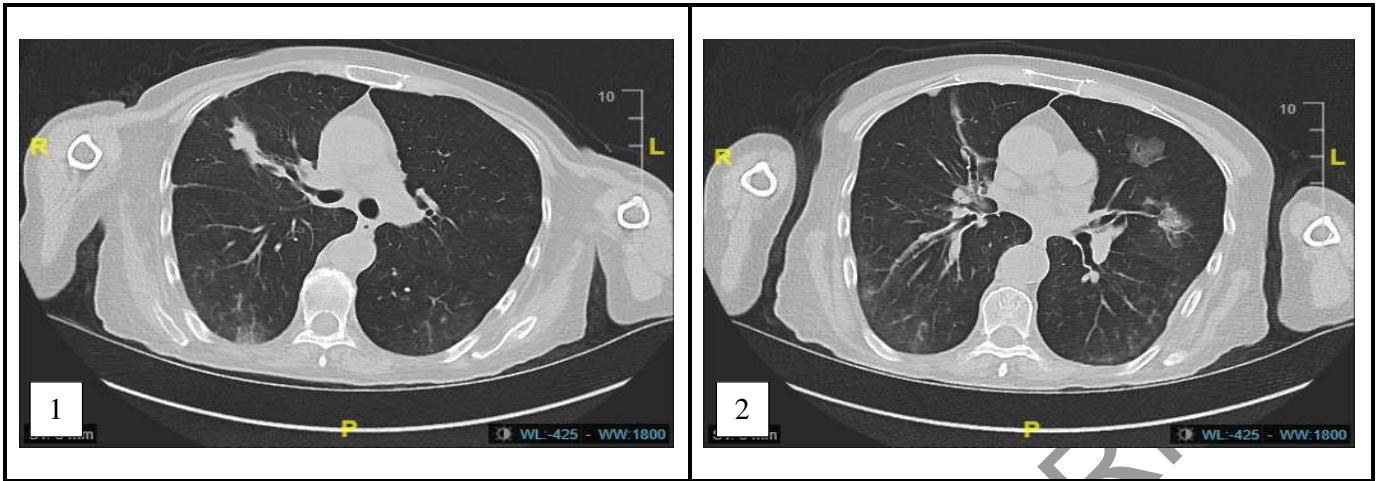


Figure 2: Chest CT on the first admission (Table 2, Patient 7)

- 1 - Fibroatelectatic changes to the right lung upper lobe, nodular ground-glass opacities mostly located in the lower lobe of the right lung compatible with COVID-19 pneumonia
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