DOI: 10.37990/medr.1019109 Med Records 2022;4(2):141-7

MEDICAL RECORDS-International Medical Journal

Research Article

Investigation of Clinical and Sociodemographic Characteristics of Critically Patients with COVID-19 Admitted to Intensive Care Unit

Yoğun Bakım Ünitesine Kabul Edilen COVID-19'lu Kritik Hastaların Klinik ve Sosyodemografik Özelliklerinin İncelenmesi

Sabri Abus[1], Olga Bayar Kapici[2]

[1]Kahta State Hospital, Department of Cardiology Specialist, Adiyaman, Turkey
[2]Adiyaman Training and Research Hospital, Department of Radiology, Specialist, Adiyaman, Turkey

Abstract

Aim: It is known that there is an increased risk of mortality due to COVID-19 in people with comorbid diseases. In this study, it was aimed to examine the comorbid diseases of patients treated in the intensive care unit due to COVID-19 and the effects of these diseases on mortality.

Material and Methods: In this study, the clinical and sociodemographic characteristics of 220 patients who were treated in the intensive care unit due to Covid-19 in a district state hospital between 01/06/2020-01/01/2021 were retrospectively analyzed.

Results: The mean age, urea, creatine, CRP, WBC, and neutrophil count were found to be significantly higher in the non-survivor group compared to the survivor group. Lymphocyte count, eosinophil count, HGB, and HCT were significantly higher in the survivor group. It was found that mortality was significantly increased in COVID-19 patients with DM, HT, CRF, COPD comorbid diseases.

Conclusion: According to the results we found, it is necessary to be more careful in the intensive care follow-up of COVID-19 patients with comorbid diseases such as DM, HT, COPD, CKD.

Keywords: COVID-19, intensive care, mortality, comorbidity

Öz

Amaç: Komorbid hastalıkları olan kişilerde COVID-19 nedeniyle mortalite riskinde artış olduğu bilinmektedir. Bu çalışmada COVID-19 nedeniyle yoğun bakım ünitesinde tedavi gören hastaların komorbid hastalıkları ve bu hastalıkların mortalite üzerindeki etkisinin incelenmesi amaçlanmıştır.

Materyal ve Metot: Bu çalışmada 01/06/2020-01/01/2021 tarihleri arasında bir ilçe devlet hastanesi'nde COVID-19 nedeniyle yoğun bakım ünitesinde tedavi gören 220 hastanın klinik ve sosyodemografik özellikleri retrospektif olarak incelenmiştir.

Bulgular: Yaş ortalaması, üre, kreatin, CRP, WBC ve nötrofil sayısı, yaşamını yitiren grupta, hayatta kalan gruba kıyasla anlamlı derecede yüksek bulundu. Hayatta kalan grupta lenfosit sayısı, eozinofil sayısı, HGB ve HCT anlamlı olarak daha yüksekti. DM, HT, KBY, KOAH komorbid hastalıkları olan COVID-19 hastalarında mortalitenin önemli ölçüde arttığı bulundu.

Sonuç: Bulduğumuz sonuçlara göre DM, HT, KOAH, KBY gibi komorbid hastalıkları olan COVID-19 hastalarının yoğun bakım takibinde daha dikkatli olunması gerekmektedir.

Anahtar Kelimeler: COVID-19, yoğun bakım, mortalite, komorbidite

INTRODUCTION

In December 2019, cases of pneumonia, whose clinical appearance resembled viral infections, emerged in Wuhan city of China for an unknown reason. Later, after examining the samples taken from the lower respiratory tract, a new type of coronavirus was identified and named 2019-nCoV. The disease resulted from this virus was named COVID-19 (1). COVID-19 often causes cough, fever, shortness of breath, muscle and joint pain, malaise, gastrointestinal complaints, and loss of smell and taste. COVID-19 has affected many countries worldwide due to severe pneumonia it causes, and the persistence of person-to-person transmission has made it a global concern and a major public health risk (2).

The need for intensive care treatment may arise between 2-10 days in hospitalizations due to COVID-19 pneumonia. COVID-19 may cause the need for intensive care in 5% of patients (3). For this reason, the evaluation of the clinical

Received: 04.11.2021 **Accepted:** 15.01.2022
Corresponding Author: Sabri Abus, Kahta State Hospital, Department of Cardiology Specialist, Adıyaman, Turkey,
E-mail: sabri_abus@hotmail.com

features of patients receiving intensive care treatment gains importance in the regulation of treatment (4). It has been shown in studies that the prognosis of COVID-19 is worse in people with diabetes mellitus (DM) of any age. It has been reported that morbidity, mortality, intensive care unit hospitalization rates and length of stay in the hospital are higher in COVID-19 patients with DM (5). Studies have shown that patients with chronic obstructive pulmonary disease (COPD) or those with any respiratory system disease have a more severe course of COVID-19, and death rates in COVID-19 patients with COPD increase four times compared to other patients (6).

In this study, it was aimed to examine the comorbid diseases of patients treated in the intensive care unit due to COVID-19 and the effects of these diseases on mortality.

MATERIAL AND METHOD

Study Sample

Two hundred twenty patients who admitted to intensive care unit due to COVID-19 in Kahta State Hospital between 01/06/2020-01/01/2021 were included in the study. In this study, COVID-19 patients were divided into two groups. The group that died due to COVID-19 was defined as non-survivor (NS), and the recovered COVID-19 patients were defined as survivor (S). Comorbid disease information of the patients was obtained from their medical history and from our hospital database.

This study was carried out following the ethical standards of the liable institution for human subjects and the Declaration of Helsinki. Research ethics approval was acquired from the Non-Invasive Ethics Committee of Adıyaman University Medical Faculty (Decision Date: 16/02/2021, Decision Number: 2021/02-38).

All patients admitted to an outpatient clinic or the emergency department with cough, dyspnea, headache, fever, myalgia, malaise, loss of appetite, weight loss, sore throat, diarrhea, nausea, vomiting, rhinitis, or loss of smell should undergo a complete medical assessment, physical examination, laboratory examination, and thorax CT done. Clinical, laboratory, radiological, and epidemiological findings were obtained from electronic medical archives and recorded documentation forms. While some patients in this study were treated in inpatient services due to COVID-19, they were taken to the intensive care unit due to worsening in their clinics.

SARS-CoV-2 pneumonia diagnosis was made according to the interim guidelines of the World Health Organization (7). COVID-19 patients, who had shortness of breath despite 5 L/min oxygen, respiratory rate >30/min, tachycardia >100/min, blood oxygen saturation level <90%, ratio of partial pressure of arterial oxygen to fraction of inspired oxygen<300 mm Hg, on chest X-ray >% 50 infiltration, need for mechanical ventilation, development of acute organ dysfunction, sepsis, septic shock, immunosuppression, acute bleeding diathesis, arrhythmia or increased troponin level, were followed in the intensive care unit (ICU) (8).

Table 1. Comparison of demographic and laboratory values in non-survivor and survivor groups

	Survivor (n=142) Mean ± SD	Non-survivor (n=78) Mean ± SD	p value
Gender-Female *	(n=66) (%46.5)	(n=38) (%48.7)	0.750
Age	69.41±16.47	76±11.94	0.004
Peak Urea	66.54±49.36	127.99±73.93	<0.001
Peak Creatine	1.16±0.98	2.08±1.45	<0.001
Peak CRP	6.19±5.21	10.46±7.91	<0.001
WBC	11881.35±5868.23	15602.65±8015.37	<0.001
HGB	12.96 ±2.24	12.23±2.61	0.018
HCT	40.50±7.19	38.32±8.09	0.009
Neutrophil	9168.11±5588.81	12798.06±8072.73	<0.001
Lymphocyte	2107.40±2057.47	1754.43±2217.95	0.007
Monocyte	434.80±359.17	508.04±448.37	0.321
Eosinophil	100.65±195.25	67.41±178.02	0.004
Basophil	95.36±148.55	125.21±207.16	0.542
ICU Period	9.24±10.82	10.21±10.36	0.098
Number of Comorbid Diseases	2.92±1.71	1.06±1.42	<0.001

Mann Whitney U-test was applied. A p<0.05 statistical significance value was accepted.
* Chi-square test was applied.
CRP: C-reactive protein, WBC: White blood cell, HGB: Hemoglobin, HCT: Hematocrit

According to the treatment guidelines of the Ministry of Health, mechanical ventilation is planned for COVID-19 patients with signs of dyspnea, tachypnea (>30/min), use of additional respiratory muscles, paradoxical breathing, respiratory alkalosis (PaCO2 < 35 mmHg, pH >7.45) (9).

Reverse transcriptase polymerase chain reaction test (RT-PCR) negative patients and suspected COVID-19 patients were not included in the study. Patients whose comorbid disease information could not be reached were not included in the study.

Laboratory Analysis

Venous blood samples were examined during hospital admission, in the intensive care unit, and whenever necessary to assess the patient's clinical status. Total white blood cell count and neutrophil, lymphocyte, monocytes, eosinophil, and basophil counts were measured using a device (CELL-DYN Ruby; Abbott Diagnostics, Abbott Park, IL) and given as x 103 cells/mm3. Hemoglobin, hematocrit, and thrombocyte counts were also calculated. Creatinine, urea, and C-reactive protein (CRP) levels were analyzed using biochemistry kits (Abbott Diagnostics) and an Architect c8000 Chemistry System (Abbott Diagnostics) machine. Peak hemogram, biochemistry, and CRP values were recorded in the intensive care follow-up of the patients.

Nasopharyngeal swab samples were picked up by professional health personnel in a particular sampling room. Nasopharyngeal swab samples of the patients were analyzed by RT-PCR. Those with positive RT-PCR test were included in the study.

Radiological Evaluation

In COVID-19 patients, thoracic CT shows unilateral/bilateral patchy ground-glass density areas predominantly in the middle and lower lobes of the lungs. Areas of this ground glass density can also mimic consolidation or organized pneumonia. Interlobular septal thickening and honeycomb formation may also be seen (10).

Findings in the chest X-ray of COVID-19 patients may be normal in the early stages of the disease, or there may

Table 2. Comparison of the incidence of additional diseases in the non-survivor and survivor groups

	Survivor (n=142) (%64.5)	Non-survivor (n=78) (%35.5)	p value
DM	22 (%10)	33 (%15)	<0.001
HT	43 (%19.5)	67 (%30.5)	<0.001
COPD	26 (%11.8)	55 (%25)	<0.001
CAD	23 (%10.5)	27 (%12.3)	0.002
CKD	5 (%2.3)	23 (%10.5)	<0.001
CHF	20 (%9.1)	18 (%8.2)	0.091
AF	12 (%5.5)	5 (%2.3)	0.588

The chi-square test was used. A p<0.05 statistical significance value was accepted.
DM: Diabetes Mellitus, HT: Hypertension, COPD: Chronic Obstructive Pulmonary Disease, CAD: Coronary Artery Disease, CKD: Chronic Kidney Disease, CHF: Congestive Heart Failure, AF: Atrial Fibrillation

Table 3. Evaluation of the effect of comorbid diseases on mortality due to COVID-19 according to regression analysis

	B	p value	Odds Ratio	95% CI	
				Lower	Upper
DM	1.074	0.045	2.928	1.024	8.373
HT	2.140	<0.001	8.499	3.548	20.361
COPD	1.942	<0.001	6.973	3.090	15.735
CAD	0.147	0.827	1.158	0.311	4.305
CKD	2.162	<0.001	8.688	2.319	32.552
CHF	-0.439	0.582	0.645	0.135	3.080
AF	-1.831	0.05	0.160	0.026	0.997
Constant	-3.134	0.000	0.044		

A Binary logistic regression test was used. A p<0.05 statistical significance value was accepted. DM: Diabetes Mellitus, HT: Hypertension, COPD: Chronic Obstructive Pulmonary Disease, CAD: Coronary Artery Disease, CKD: Chronic Kidney Disease, CHF: Congestive Heart Failure, AF: Atrial Fibrillation

be predominantly peripheral opacities in the unilateral/ bilateral subzones. In addition, the sensitivity of this imaging method is low since underlying diseases such as COPD and congestive heart failure (CHF) may also affect the chest X-ray (11).

Statistical analysis

All analyzes were performed in SPSS26.0 for Mac (SPSS Inc., Chicago, IL). Categorical data were expressed as numbers and percentages. The conformity of the data to the normal distribution was evaluated using the Kolmogorov-Smirnov test. The mean and standard deviation values of the continuous data were given. The Mann-Whitney U test was used to evaluate the difference between the two groups of non-normally distributed data. The chi-square test was used to compare the prevalence of comorbid diseases between the groups. Binary logistic regression analysis was used to assess the effect of comorbid diseases on the risk of death from COVID-19. P<0.05 was accepted as a statistical significance value.

RESULTS

The mean age of 220 COVID-19 patients hospitalized in the ICU was 71.69±15.37 years. 116 (52.7%) of the patients were male. 72 (32.7%) of the patients were intubated. COVID-19 was fatal in 78 (35.5%) of the patients. Hypertension (HT) in 110 (50%) patients, COPD in 81 (36.8%), DM in 55 (25%), coronary artery disease (CAD) in 50 (22.7%) patients, 38 (17.3%) patients had chronic kidney disease (CKD), 38 (%17,2) patients had CHF and 17 (7.7%) patients had atrial fibrillation (AF).

Demographic, laboratory, and radiological comparisons of NS and S groups are shown in Table-1.

The mean age in the NS was significantly higher than in the S. Urea, creatine, CRP, WBC, and neutrophil counts were significantly higher in the NS than in the S. HCT, lymphocyte count, and eosinophil count were significantly lower in the NS compared to the S. There was no significant difference between the groups in terms of gender distribution. The number of comorbid diseases was in the NS significantly higher than in S.

The comparison of the prevalence of comorbid diseases in the NS and S are shown in Table-2.

DM, HT, COPD, CAD, CKD were significantly common in the NS. However, there was no significant difference in prevalence between the two groups regarding CHF and AF.

According to logistic regression analysis, the evaluation of the effect of comorbid diseases on mortality due to COVID-19 is shown in Table-3.

According to the logistic regression model, DM, HT, COPD, CKD increased mortality risk due to COVID-19. (Nagelkerke R square=0.58, -2 Log likelihood= 165.401) This regression model explains the risk of mortality due to COVID-19 at the rate of 58%. Based on odds ratios, it is understood that CKD and HT increase mortality risk the most. However, CAD, CHF, and AF were not identified as risk factors for mortality due to COVID-19.

Figure 1 shows the incidence of comorbid diseases and the mortality rate from COVID-19. According to this, while the death rate is 3.9% in the group without comorbid disease, this rate rises to 65.1% in those with two comorbid diseases.

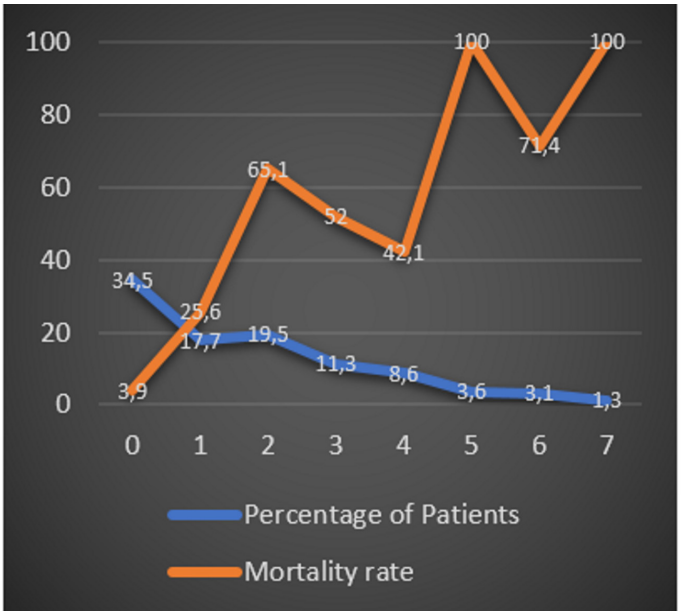

Figure 1. Number of comorbid diseases and mortality rate X-axis: Number of comorbid diseases, Y-axis: Percent (%)

DISCUSSION

Identification of predictive factors for severe infection is necessary to analyze patients' risk status due to the COVID-19 pandemic and to guide public health recommendations with the appropriate use of hospital resources (12).

This study defined the relationship between patients' comorbid conditions followed in the ICU due to COVID-19 and the mortality rate. In the present study the hospitalization rate in ICUs due to COVID-19 in males was higher than females. However, we did not find a significant difference between the genders regarding mortality.

Yang et al. examined the clinical and sociodemographic data of 52 patients receiving intensive care treatment for COVID-19. They found that the mean age of the patients was 59.7±13.3 years. While 35 (67%) of the patients were male, 17 (33%) were female, 21 (40%) had a chronic disease. Thirty-two (61.5%) of the patients died an average of 28 days after hospitalization. The average duration of the transition from hospitalization to the ICU was seven days. The mean age of the non-survivors was 64.6±11.2 (13). In our study, the mean age of the NS was higher. It can be said that Yang et al. did their research early stages of the COVID-19 pandemic. Progress in the treatment of COVID-19 during the pandemic process may be related to the increase in the average age of the patients in ICUs. In

this study, 144 (65%) patients with COVID-19 had at least one comorbid disease. Despite the higher rate of comorbid disease, the lower mortality rate in our study may be related to better recognition of COVID-19 and improved treatment opportunities. In addition, we think that the treatment of comorbid diseases in COVID-19 patients may have been disrupted in the first period of the pandemic.

Graselli et al., in their study in the Lombardy region of Italy, one of the regions first affected by the COVID-19 pandemic, examined 3988 patients treated in intensive care due to COVID-19 infection. In their research the mean age of the patients was 63 years. While 79.9% of the patients were male, 60.1% of them were found to have at least one comorbid disease. Mechanical ventilation was required in 87.3% of the patients (14). In our study, the rate of mechanical ventilation was found to be 32.7%. Similarly, the rate of those with at least one comorbid disease in our study was 65%.

Mitra et al. in their study on 117 patients receiving intensive care treatment due to COVID-19, found the mean age of the patients to be 69, while 79 (67.5%) of the patients were male. In their research while the number of patients with at least one comorbid disease was 86 (73.5%), the number of those who needed mechanical ventilation was 74 (63.2%). Eighteen of the patients (15.4%) died (15). In our study, a 35.5% mortality rate was found. This difference may be related to the time of admission to the hospital and the late initiation of treatment. It can also be said that the prognosis of COVID-19 is not as poor as before.

It has been reported that men with COVID-19 have a higher risk of severe illness and death than women. It was thought that respiratory tract diseases tend to be more severe in males and lead to more frequent deaths as the reason for this (16). The reason for this is that cardiovascular diseases are seen more frequently in men and the ratio of Angiotensin-converting enzyme/Angiotensin-converting enzyme 2 (ACE/ACE2) is low in women (17). Also, during the SARS epidemic in 2003, the mortality rate was higher in males (18). However, we did not find a significant difference in mortality rates in our study. Although, we found that men with COVID-19 were admitted to intensive care more frequently. The absence of a significant difference in mortality rates between the sexes in our study can be explained because women have more comorbidities than men in terms of comorbidity rates. This can be explained by the fact that HT was more common in women in our study (54.8%-45.8%). We found HT to be a risk factor for mortality in our study. We think that comorbid diseases may have a more predictive effect on mortality than gender.

Our study observed that the percentage of HT, COPD, DM, CKD was significantly higher in patients with severe COVID-19 and hospitalization in the ICU, use of mechanical ventilation, or death. Guan et al. found that the frequency of HT, DM, CAD, cerebrovascular disease, COPD, CKD, and cancer was significantly higher in patients with severe COVID-19 admitted to the ICU and required mechanical ventilation or died (16). Shi et al. reported that HT, DM, CAD, cerebrovascular disease, COPD, and cancer are more common in COVID-19 and myocardial damage (18). There was no statistically significant difference between the NS and S for CAD, CHF, and AF in our study.

It has been reported that ACE2 levels are high in cardiovascular diseases. It is thought that COVID-19 is more severe in cardiovascular diseases due to the use of ACE2 receptors by COVID-19. It has been reported that plasma ACE2 level is increased in AF and can be used to determine the severity of AF. Although AF was reported to be more common in severe COVID-19 (19), we could not conclude in our study that AF increased mortality. It is emphasized that well-controlled AF does not pose a risk for COVID-19 mortality (20). This result we found may be due to the regular use of antiarrhythmic treatments.

DM has been indicated as essential predictors of severity and mortality in patients infected with different viruses, comprising the 2009 influenza A pandemic (H1N1) (21), MERS-CoV (22), and SARS-CoV (23). Some studies from China (18,24) and Italy (25) showed that elderly patients with comorbid diseases, including DM, are at higher risk for severe COVID-19 and mortality. However, some studies have found no association between DM and severe COVID-19 (26,27). More recent data from Italy and the United States have associated COPD with a significantly more severe COVID-19 infection with a more than five-fold increased risk (28,29).

Emma et al. examined the comorbidities of COVID-19 and various diseases using meta-analysis from various early studies and found that just five articles had reported COPD. The prevalence of COVID-19 patients with COPD was only 0.95%, a relatively small number compared to other pre-existing conditions (20). The reason may be the difficulty in detecting COPD in China or that patients provide information about their comorbid conditions at hospitalization. We think that underreporting comorbidities due to lack of awareness or diagnostic tests may affect the relationships between comorbidities and clinical outcomes.

Chronic Kidney disease (CKD) is affiliated with a growing risk of pneumonia, both inpatient and outpatient (31). Pneumonia-related mortality rates in CKD patients are considerably higher than in the entire population (32). In this research, we obtained similar results to these studies. However, there was insufficient data on the subgroups and degree of CKD. The number of publications advocating that CKD is the most important risk factor for COVID-19 mortality is increasing (33). We also found that CKD increases the risk of mortality about 8.8 times.

Although our study included the cross-sectional data of a district state hospital, we found that comorbid diseases such as DM, HT, COPD, and CKD significantly increased the mortality risk due to COVID-19. Patients with these comorbid diseases should be followed carefully for COVID-19.

This study has some limitations. Since our study was retrospective, we did not have enough data about

socioeconomic status or ethnicity. Our study includes a small sample because it only covers the data of one district state hospital.

CONCLUSION

People with additional diseases that increase the mortality of COVID-19, which we mentioned in our study, need to be more careful about COVID-19, and in case these people have COVID-19, physicians should follow these patients more closely.

Financial disclosures: *The authors declared that this study hasn't received no financial support.*

Conflict of Interest: *The authors declare that they have no competing interest.*

Ethical approval: *Research ethics approval was acquired from the Non-Invasive Ethics Committee of Adıyaman University Medical Faculty (Decision Date: 16/02/2021, Decision Number: 2021/02-38).*

REFERENCES

1. Jin Y, Yang H, Ji W, et al. Virology, epidemiology, pathogenesis, and control of COVID-19. Viruses. 2020;12: 372.
2. Li H, Liu SM, Yu XH, et al. Coronavirus disease 2019 (COVID-19): current status and future perspectives. Int J Antimicrob Agents. 2020;55:105951.
3. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet. 2020;395:497-506.
4. Murthy S, Gomersall CD, Fowler RA. Care for critically ill patients with COVID-19. Jama. 2020;323:1499-500.
5. Singh AK, Gupta R, Ghosh A, Misra A. Diabetes in COVID-19: Prevalence, pathophysiology, prognosis and practical considerations. Diabetes Metab Syndr Clin Res Rev. 2020;14:303-10.
6. Zhao Q, Meng M, Kumar R, et al. The impact of COPD and smoking history on the severity of COVID 19: A systemic review and meta analysis. J Med Virol. 2020;92:1915-21.
7. https://www.who.int/publications-detail-redirect/WHO-2019-nCoV-clinical-2021-1.
8. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese center for disease control and prevention. JAMA. 2020;323:1239-42.
9. T.R. Ministry of Health Scientific Advisory Board Study COVID-19 (SARS-CoV-2 INFECTION) SEVERE PNEUMONIA, ARDS, SEPSIS AND SEPTIC SHOCK MANAGEMENT, 1 June 2020, Ankara. https://covid19bilgi.saglik.gov.tr/depo/rehberler/ covid19rehberi/COVID19_REHBERI_AGIR_PNOMONI_ARDS_ SEPSIS_VE_SEPTIK_SOK_YONTEMI.pdf access date 29.03.2021.
10. Mossa-Basha M, Meltzer CC, Kim DC, et al. Radiology department preparedness for COVID-19: radiology scientific expert review panel.2020.
11. Kanne JP, Bai H, Bernheim A, et al. COVID-19 imaging: What we know now and what remains unknown. Radiology, 2021;299:E262-79.
12. Hartley DM, Perencevich EN. Public health interventions for COVID-19: emerging evidence and implications for an evolving public health crisis. Jama. 2020;323:1908-9.
13. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Resp Med. 2020;8:475-81.
14. Grasselli G, Greco M, Zanella A, et al. Risk factors associated with mortality among patients with COVID-19 in intensive care units in Lombardy, Italy. JAMA Intern Med. 2020;180:1345-55.
15. Mitra AR, Fergusson NA, Lloyd-Smith E, et al. Baseline characteristics and outcomes of patients with COVID-19 admitted to intensive care units in Vancouver, Canada: a case series. Cmaj. 2020;192:E694-E701.
16. Guan WJ, jie Ni Z-yi, Hu Y, et al. Clinical characteristics of coronavirus disease. NEJM. 2019;1708-20.
17. Penna C, Mercurio V, Tocchetti CG, Pagliaro P. Sex related differences in COVID 19 lethality. Br J Pharmacol. 2020;177:4375-85.
18. Shi S, Qin M, Shen B, et al. Association of cardiac injury with mortality in hospitalized patients with COVID-19 in Wuhan, China. JAMA cardiology. 2020;5:802-10.
19. Du Y, Tu L, Zhu P, et al. Clinical features of 85 fatal cases of COVID-19 from Wuhan. A retrospective observational study. Am J Respir Crit Care Med. 2020;201:1372-9.
20. Sanchis-Gomar F, Perez-Quilis C, Lavie CJ. Should atrial fibrillation be considered a cardiovascular risk factor for a worse prognosis in COVID-19 patients?. Eur. 2020;41:3092-3.
21. Schoen K, Horvat N, Guerreiro NF, et al. Spectrum of clinical and radiographic findings in patients with diagnosis of H1N1 and correlation with clinical severity. BMC Infecti Dis. 2019;19:1-8.
22. Banik GR, Alqahtani AS, Booy R, et al. Risk factors for severity and mortality in patients with MERS-CoV: Analysis of publicly available data from Saudi Arabia. Virologica Sinica. 2016;31:81-4.
23. Yang JK, Feng Y, Yuan MY, et al. Plasma glucose levels and diabetes are independent predictors for mortality and morbidity in patients with SARS. Diabet Med. 2006;23:623-8.
24. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. Jama. 2020;323:1239-42.
25. Onder G, Rezza G, Brusaferro S. Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. Jama. 2020;323:1775-6.
26. Zhang JJ, Dong X, Cao YY, et al. Clinical characteristics of 140 patients infected with SARS CoV 2 in Wuhan, China. Allergy. 2020;75:1730-41.
27. Lippi G, Plebani M. Laboratory abnormalities in patients with COVID-2019 infection. Clin Chem Lab Med (CCLM). 2020;58:1131-4.

28. Lippi G, Henry BM. Chronic obstructive pulmonary disease is associated with severe coronavirus disease 2019 (COVID-19). Respir Med. 2020;167:105941.

29. Gold JA, Wong KK, Szablewski CM, et al. Characteristics and clinical outcomes of adult patients hospitalized with COVID-19—Georgia, March 2020. Morbidity and Mortality Weekly Report. 2020;69:545.

30. Emami A, Javanmardi F, Pirbonyeh N, et al. Prevalence of underlying diseases in hospitalized patients with COVID-19: a systematic review and meta-analysis. Arch Acad Emerg Med. 2020;8.

31. Chou CY, Wang SM, Liang CC, et al. Risk of pneumonia among patients with chronic kidney disease in outpatient and inpatient settings: a nationwide population-based study. Medicine. 2014;93.

32. Cascella M, Rajnik M, Aleem A, et al. Features, evaluation, and treatment of coronavirus (COVID-19). StatPearls. 2021.

33. Gansevoort RT, Hilbrands LB. CKD is a key risk factor for COVID-19 mortality. Nat Rev Nephrol. 2020;16:705-6.