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Outcomes of wuhan, alpha, delta, omicron and other variants in severe acute respiratory syndrome coronavirus-2

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COVID-19 is an infectious disease caused by SARS-CoV-2 whose mutation has been a cause of concern in the fight against this pandemic. Here, we analysed the clinical outcomes of the mutations of the SARS-Cov-2 virus for a retrospectvie period of April 2020 to January 2022. Patients with negative PCR test results and without pneumonia were excluded from the study. A total of 675 patients' ages, genders, comorbidities, mutations, vaccines, laboratory parameters, treatments, oxygen supports, need for Intensive-care, hospital stay, and mortality rates were analyzed. Statistical analysis of data was done with the Chi-square test. The mean age of patients was 61.0±1.21 years. The gender composition was 50.9% males and 49.1% females. Patients age group composition was >60 (52.5%), 41-60 (36.7%) and 20-40 (10.8%) respectively. SARS-CoV-2 variants were alpha, delta, omicron, and others (beta, gamma, eta, teta and zeta). The rate of comorbidities was 48.1%. About 65.3% of the patients were unvaccinated and 24% two-doses vaccinated. With regard to oxygen support, 28% had reservoir mask, 13.5% nasal cannula, 4.3% CPAP, 1.4% HFOT and intubation, 34.3%. The mean of hospital stay was 9.5±0.57 days. The rate of admission to the ıntensive-care units was 62.1%. The mortality rate was 32%. Variants Omicron, Alpha, and others were most common among 20-40, 41-60 and >60 age groups, respectively. Omicron was more often in females than males. Wuhan type was associated with comorbidities while Omicron showed no comorbidities. Omicron and Delta were more common in completely vaccinated whereas unvaccinated patients had Wuhan type. Patients with Wuhan and Delta types had Sepsis, and Wuhan and Alpha patients had dialysis. Intubations were more common in Wuhan and Delta variants. Patients with Omicron variant had shortest hospital stay. Wuhan, Delta and other variants (beta, gamma, eta, teta and zeta) showed comparatively high mortality.

Keywords: Comorbity, COVID-19, SARS-CoV-2 variants

Coronavirus 2019 disease (COVID-19), which has a serious impact on the world demographic, is an infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Scientific datas about the pathogenesis mechanisms of the virus is limited and studies are underway[1]. Respiratory transmission of the disease from person to person was observed to be very rapid. COVID-19 was reported to be transmitted mainly at households[2]. Therefore, quarantine was important in the fight against this disease. As small droplets of the virus reach mucosa by aerosol, the disease spreads faster. Presence of RNA of SARS-CoV-2 virus on household surfaces has also been reported[4,5].

SARS-CoV-2, being a RNA virus, continues to mutate and form variants with different characteristics causing illness in host cells. Alpha (in the United Kingdom), Beta (in South Africa), and Delta variant (in India) were reported in December 2020. A Gamma variant (in Brazil) was reported in January 2021 and an Omicron variant in November 2021 (in South Africa)[6]. Due to the mutations of SARS-CoV-2, the disease is resistant to treatment[7]. Although it usually has an aggressive course, the mortality is reported to have reduced in the Omicron variant[8]. However, some mutations have been observed to be more aggressive. Mutation of the viral pathogen despite global vaccination efforts make the fight against the pandemic challenging. Few mutants which are more virulent and fatal for some period of time become less virulent later. This retrospective study investigates the differences and clinical outcomes of the mutations of the SARS-Cov-2 virus, which caused pandemic during 2020-21 at Ersin Arslan Training and Research Hospital, Gaziantep in Turkey.

Materials and Methods

The study was done to cover the period between April 2020 and January 2022 and as a retrospective in

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the pandemic wards and critical care of the hospital. Patients with negative Polymerase Chain Reaction (PCR) test results (at least 2 replicates) and without pneumonia were excluded from the study. A total of 675 patients were included in the study. Patients' ages, genders, comorbidities, PCR tests, mutation types, vaccine information, vaccine doses and types, COVID-19 Reporting and Data System (CO-RADS) results on Computed Tomography (CT), laboratory parameters, steroid or anticytokine use, dialysis, growth in bacterial culture, oxygen support type, need for Intensive-care, length of hospital stay, mortality rates and causes were analyzed in the study. The reference range of our hospital was received as a normal value in laboratory results. According to these were White Blood Cell (WBC) 4-10 µL, Lymphocyte (LYM) 0.8-4.8 µL, C-reactive protein (CRP) 0-5 mg/L, Procalcitonin (PCT) 0-0.05 µg/L, Ferritin (FER) 20-250 ng/mL, Fibrinogen (FIB) 200-300 g/L, Lactate Dehydrogenase (LDH) 135-225 U/L, D-Dimer (DD) 0-0.5 ng/mL, Blood Urea Nitrogen (BUN) 4.6-24 mg/dL, Glomerular Filtration Rate (GFR) 75-100 mg/dL and Creatinine (CRE) 0.7-1.2 mg/dL. Statistical analysis of the study was done with Chi-square test with a 95% Confidence Interval (CI) and $P < 0.05$ significance.

Ethical approval for this study was obtained from Republic of Turkey Ministry of Health (2021-12-06T11_42_48) and University of Gaziantep Islam Science and Technology Medical Ethics Committee (2021/323).

Results

The patients were analyzed retrospectively according to the criteria of the study. They were 50.9% males and 49.1% females in the study. The mean ages were 61.0 ± 1.21 years. COVID-19 was seen in 52.5% older than 60 ages, 36.7% of the 41-60 ages group, and 10.8% of the 20-40 ages group in the patients. The rate of patients with comorbidities was 48.1%. In order of frequency these were Hypertension (HT, 28.4%), Diabetes Mellitus (DM, 25.8%), Chronic Obstructive Pulmonary Disease (COPD, 19.8%), heart pathologies (Coronary Artery Disease and Heart Failure, 11.2%), Renal Failure (6.1%), malignancies (4.8%) and others. In the study, 65.3% of the patients were unvaccinated and 24% were two-doses vaccinated. They were seen as incompleted vaccinated 10.7% in the study. Only 18.5% of the patients didn't need to oxygen support. Its forms support of oxygen; reservoir mask 28%, nasal cannula 13.5%, Continuous Positive Airway Pressure (CPAP) 4.3%, High Flow Oxygen Therapy (HFOT) 1.4% and intubation 34.3%. The mean lenght of hospital stays was 9.5 ± 0.57 days. They were observed admitted to the Intensive-care Unit of 62.1% of COVID-19 patients due to respiratory distress. Completely recovered were discharged from the hospital of 68% of all patients. However, 32% of the patients died (Table 1).

According to PCR results variants were Wuhan (the first form of the virus), Alpha (B.1.1.7), Delta

Table 1 — Distribution of demographic and clinical data of patients with COVID-19

Parameters		All types (n=675)	Wuhan (n=178)	Alpha (n=14)	Delta (n=256)	Omicron (n=65)	Others* (n=162)
Age	Average	61.0±1.21	63.4±2.16	60.7±9.8	60.4±2.1	60.3±4.2	59.3±2.5
	20-40 years	10.8% (73)	6.2% (11)	21.4% (3)	11.7% (30)	10.7% (7)	13.5% (22)
	41-60 years	36.7% (248)	36.5% (65)	0.7% (1)	36.7% (94)	38.4% (25)	38.9% (63)
	> 60 years	52.5% (354)	57.3% (102)	77.9% (10)	51.6% (132)	50.9% (33)	47.6% (77)
Gender	Male	50.9% (344)	56.2% (100)	35.7% (5)	51.1% (131)	50.7% (33)	46.2% (75)
	Female	49.1% (331)	43.8% (78)	64.3% (9)	48.9% (125)	49.3% (32)	53.8% (87)
Comorbidity	Yes	48.1% (325)	37% (66)	57.1% (8)	52.3% (134)	55.3% (36)	50% (81)
	No	51.9% (350)	63% (112)	42.9% (6)	47.7% (122)	44.7% (29)	50% (81)
Vaccination	2 doses vaccinated	24% (162)	29.8% (53)	28.5% (4)	22.2% (57)	21.5% (14)	20.9% (34)
	Incomplete (1 dose)	10.7% (72)	9.6% (17)	0	10.1% (26)	15.3% (10)	11.7% (19)
	Unvaccinated	65.3% (441)	60.6% (108)	71.5% (10)	67.7% (173)	63.2% (41)	67.4% (109)
Support of oxygen	No support	18.5% (125)	7.3% (13)	21.4% (3)	22.2% (57)	16.9% (11)	25.3% (41)
	Nasal cannula	13.5% (91)	4.5% (8)	14.3% (2)	15.6% (40)	20% (13)	17.2% (28)
	Reservoir mask	28% (189)	21.9% (39)	21.4% (3)	27.3% (70)	30.8% (20)	35.3% (57)
	HFOT[#]	1.4% (9)	0.6% (1)	0	0.4% (1)	9.2% (6)	0.6% (1)
	CPAP[##]	4.3% (29)	6.2% (11)	0	3.5% (9)	7.7% (5)	2.5% (4)
	Intubation	34.3% (232)	59.5% (106)	42.9% (6)	31% (79)	15.4% (10)	19.1% (31)
Length of hospital stay		9.5±0.57	10.0±1.24	7.0±3.50	9.5±0.79	8.2±2.90	9.5±0.93
Hospitalization	Wards	37.9% (256)	12.4% (22)	35.7% (5)	44.9% (115)	36.9% (24)	55.5% (90)
	Intensive-care	62.1% (419)	87.6% (156)	64.3% (9)	55.1% (141)	86.4% (41)	44.5% (72)
Hospital discharge		68% (459)	51.1% (91)	57.1% (8)	70.7% (181)	72.3% (47)	81.4% (132)
Mortality		32% (216)	48.9% (87)	42.9% (6)	29.3% (75)	27.7% (18)	18.6% (30)

[*Others: Beta, Gamma, Zeta, Eta and Teta variants. [#]HFOT: High Flow Oxygen Therapy; [##]CPAP: Continuous Positive Airway Pressure]

(B.1.617.2), Omicron (B.1.1.529), and others (Beta B.1.351, Gamma P.1, Zeta P.2, Eta B.1.525, Teta P.3). By variants, the course of clinical and symptoms were varied of COVID-19. The most common symptoms were cough (76.4%), muscle or body aches (70.2%), sore throat (57.3%), the new loss of taste or smell (46.6%), and shortness of breath (43.8%), least symptoms were diarrhea (3.3%) and fever or chills (3.9%) in Wuhan type. In order of frequency, symptoms were sore throat (64.2%), cough (57.1%), shortness of breath (57.1%), the new loss of taste or smell (35.7%), and agitation or anxiety (35.7%), least common symptoms were diarrhea, fever or chills, expectoration and headache (7.1%) in Alpha variant of COVID-19. In the Delta variant, the common symptoms were sore throat (87.1%), cough (85.9%), shortness of breath (78.9%), muscle or body aches (72.2%), and fatigue (40.2%) and, the least symptoms were fever or chills. In order of frequency, symptoms were congestion or runny nose (81.5%), sore throat (33.8%), cough (29.2%), muscle or body aches (27.6%), and new loss of taste or smell (27.6%) and, the least common symptoms were diarrhea (1.5%), fever or chills (3%) and expectoration (3%) in Omicron variant of COVID-19. In other variants (Beta, Gamma, Zeta, Eta, Teta), the most common symptoms were sore throat (74.6%), cough (64.1%), muscle or body aches (59.8%), agitation or anxiety (54.3%) and shortness of breath (48.7%) and, the least common symptoms were diarrhea (3%), fever or chills (3.7%) and nausea or vomiting (4.9%) in COVID-19 (Table 2).

Those were observed that some laboratory parameters differed among variants. The mean WBC values were within the normal ranges in all variants (9.29 ± 0.92 μL). However, leukocytosis was more frequent in the delta variant and, leukopenia was in the alpha variant. The highest mean CRP value was in the alpha variant, and the lowest CRP was in Wuhan type. The mean PCT value was normal only in the omicron variant. According to PCT mean values, these were compatible with high risk of sepsis in the alpha variant and, a moderate risk of sepsis in delta, Wuhan, and other variants. The means of FER, FIB and LDH values were high in all variants. The mean DD value was normal only in the omicron variant.The highest mean DD value was in the alpha variant. The mean BUN values was high and the mean GFR values were in the normal ranges in all variants. The mean of CRE values was high in delta and other variants. Steroid drugs were used in 90.3% of the patients and, tocilizumab was used as an anticytokine drug at a rate of 13.7% in cytokine storm in COVID-19. Dialysis treatment is taken in 7.8% of patients because of acute or chronic renal failure. Bacterial growth was detected in the blood cultures of 11.2% of the patients with COVID-19 (Table 3).

Statistical analysis was done with the Chi-square test of the study (P <0.05, 95%CI). Omicron variant (P <0.02) in the 20-40 ages, Alpha variant (P <0.03) in the 41-60 ages and, Wuhan (P <0.04) Delta variant (P <0.05) and others (P <0.06) in the more than 60 ages were statistically significant. Omicron variant was more often in females (P <0.05), and others variants were more often in males (P <0.01). Patients with comorbidities were related to SARS-CoV-2 (P <0.006) and, patients without comorbidities were related to Omicron variant (P <0.04). Delta (P <0.06) and Omicron (P <0.05) variants were more often in completely vaccinated (2 doses of Sinovac or

Table 2 — Distribution of COVID-19 symptoms

Symptoms	All types (n=675)	Wuhan (n=178)	Alpha (n=14)	Delta (n=256)	Omicron (n=65)	Others* (n=162)
Sore throat	70.6% (477)	57.3% (102)	64.2% (9)	87.1% (223)	33.8% (22)	74.6% (121)
Congestion or runny nose	38.3% (259)	29.7% (53)	14.2% (2)	32% (82)	81.5% (53)	42.5% (69)
New loss of taste or smell	38.6% (261)	46.6% (83)	35.7% (5)	39.4% (101)	27.6% (18)	33.3% (54)
Headache	19.4% (131)	14.6% (26)	7.1% (1)	29.2% (75)	16.9% (11)	11.1% (18)
Muscle or body aches	63.8% (431)	70.2% (125)	42.8% (6)	72.2% (185)	27.6% (18)	59.8% (97)
Fatigue	33.6% (227)	21.9% (39)	21.4% (3)	40.2% (103)	4.6% (3)	48.7% (79)
Cough	72.5% (490)	76.4% (136)	57.1% (8)	85.9% (220)	29.2% (19)	64.1% (104)
Expectoration	13.3% (90)	12.3% (22)	7.1% (1)	21.8% (56)	3% (2)	5.5% (9)
Shortness of breath	54.8% (370)	43.8% (78)	57.1% (8)	78.9% (202)	4.6% (3)	48.7% (79)
Nausea or vomiting	15.4% (104)	12.3% (22)	14.2% (2)	26.9% (69)	4.6% (3)	4.9% (8)
Diarrhea	6.8% (46)	3.3% (6)	7.1% (1)	12.8% (33)	1.5% (1)	3% (5)
Fever or chills	5.4% (37)	3.9% (7)	7.1% (1)	8.2% (21)	3% (2)	3.7% (6)
Agitation or anxiety	55.8% (377)	43.2% (77)	35.7% (5)	76.5% (196)	16.9% (11)	54.3% (88)
Unknown[#]	9.3% (63)	11.7% (21)	28.5% (4)	7% (18)	13.8% (9)	6.7% (11)

[*Others: Beta, Gamma, Zeta, Eta and Teta variants. [#]Unkonown: Patients without symptom information in hospital records]

Table 3 — Levels and status of selected biochemical and clinical data of patients with different SARS-CoV-2 variants

Parameters	All types	Wuhan	Alpha	Delta	Omicron	Others*
WBC (μL)	9.29 ± 0.92	9.76 ± 3.23	9.86 ± 7.62	8.96 ± 1.23	9.77 ± 1.85	9.84 ± 1.86
LYM (μL)	0.78 ± 0.08	0.87 ± 0.46	0.37 ± 0.11	0.76 ± 0.10	0.78 ± 0.37	0.85 ± 0.16
CRP (mg/L)	160.5 ± 13.9	129.5 ± 11.6	203.4 ± 55.0	188.5 ± 32.4	147.5 ± 38.1	189.1 ± 46.1
PCT (μg/L)	1.13 ± 0.02	2.70 ± 0.96	7.88 ± 0.77	2.07 ± 0.52	0.54 ± 0.05	1.99 ± 0.69
FER (ng/mL)	756.9 ± 57.8	777.8 ± 89.3	853.7 ± 50.1	708.8 ± 101	735.4 ± 212	806.8 ± 149
FIB (g/L)	444.0 ± 22.7	414.7 ± 86.4	584.3 ± 50.8	452.8 ± 27.8	365.7 ± 13.2	434.1 ± 49.8
LDH (U/L)	550.5 ± 33.1	419.2 ± 121	402.7 ± 201	597.9 ± 45.2	559.4 ± 152	483.9 ± 50.8
DD (ng/mL)	2.80 ± 0.86	2.67 ± 1.68	7.28 ± 2.61	2.99 ± 1.31	0.44 ± 0.06	1.93 ± 0.72
BUN (mg/dL)	34.9 ± 2.6	32.6 ± 3.8	50.6 ± 3.7	35.9 ± 4.6	40.5 ± 11.6	33 ± 5.4
GFR (mg/dL)	71.9 ± 4.6	71.4 ± 5.0	67.2 ± 3.9	68.6 ± 6.2	88.1 ± 3.4	70 ± 9.1
CRE (mg/dL)	0.93 ± 0.13	0.57 ± 0.14	0.92 ± 0.01	1.35 ± 0.29	0.57 ± 0.26	1.31 ± 0.38
Other data in the study						
Steroid	90.3% (610)	84.2% (150)	100% (14)	93.3% (239)	83% (54)	94.4% (153)
Tocilizumab	13.7% (93)	29.7% (53)	21.4% (3)	10.1% (26)	6.1% (4)	4.3% (7)
Dialysis	7.8% (53)	11.7% (21)	21.4% (3)	5.8% (15)	9.2% (6)	4.9% (8)
Growth in bacterial culture	11.2% (76)	7.8% (14)	7.1% (1)	16.7% (43)	7.6% (5)	8% (13)

[WBC: White Blood Cell; LYM: Lymphocyte; CRP: C-reactive protein; PCT: Procalcitonin; FER: Ferritin; FIB: Fibrinogen; LDH: Lactate Dehydrogenase; DD: D-Dimer; BUN: Blood Urea Nitrogen; GFR: Glomerular Filtration Rate; CRE: Creatinine. *Others: Beta, Gamma, Zeta, Eta and Teta variants]

Biontech) patients. Wuhan type (P <0.02) was related to unvaccinateds. Leukocytosis with Delta variant (P <0.006), Lymphopenia with SARS-CoV-2 (P <0.003), Alpha (P <0.03), and others variants (P <0.007), high Procalcitonin (sepsis) with SARS-CoV-2 (p <0.002) and Delta variant (P <0.001), high of D-Dimer (risk of coagulation) with Alpha (P <0.02) and Delta (P <0.01) variants, high of Creatinine (without comorbidity in patients) SARS-CoV-2 (P <0.001) and Delta (P <0.02) variants were statistically significant in the study. Treatments of steroid and tocilizumab were more often in SARS-CoV-2 (P <0.001, P <0.02), Delta (P <0.03, P <0.004) and others variants (P <0.04, P <0.006). Patients without respiratory distress (normal saturation in room air) were related to only Omicron variant (P <0.03). Intubation was more often in SARS-CoV-2 (P <0.01) and Delta variant (P <0.03). Patients admitted to the Intensive-care Unit were related to SARS-CoV-2 (P <0.05), Delta (P <0.01), and others variants (P <0.04). Treatment of dialysis was more often in Wuhan type (P <0.007) in patients without comorbidity. According to the length of hospital stays; days 0-5 (P <0.006), 6-10 (P <0.05), and more than 10 (P <0.04) were related Omicron, Wuhan, and Delta variants respectively. Mortality was related to Wuhan (P <0.05), Delta (P <0.03), and other variants (P <0.01) statistically in the study (Table 4).

Table 4 — Statistical analysis (level of significance) of clinical data of patients with COVID-19

Parameters	Wuhan	Alpha	Delta	Omicron	Others*
Age					
20-40				0.02	
41-60		0.03			
>60	0.04		0.05		0.06
Gender					
Male					0.01
Female				0.05	
Comorbidity					
Yes	0.006				
No				0.04	
Vaccination					
Vaccinated (two-doses)			0.06	0.05	
Unvaccinated	0.02				
Laboratory data					
Leukocytosis			0.006		
Lymphopenia	0.003	0.03			0.007
High of Procalcitonin	0.002		0.001		
High of D-Dimer		0.02	0.01		
High of Creatinine	0.001		0.02		
Treatment data					
Use of steroid	0.001		0.03		0.04
Tocilizumab	0.02		0.004		0.006
Dialysis	0.007	0.06			
Oxygen support					
No support				0.03	
Intubation	0.01		0.03		
Intensive-care Unit	0.05		0.01		0.04
Dialysis (without comorbidity)	0.007				
Lenght of hospital stay					
0-5 days				0.006	
6-10 days	0.05				
>10 days			0.04		
Mortality	0.05		0.03		0.01

[*Others: Beta, Gamma, Zeta, Eta and Teta variants. Statistical analysis was done with the Chi-square test. P <0.05 was received significant with 95% CI]

Discussion

According to the epidemiological update, five variants of SARS-Cov-2 were reported by the World

Health Organization (WHO) on Dec 11, 2021. These were Alpha (B.1.1.7), Beta (B.1.351), Delta (B.1.617.2), Gamma (P.1), and Omicron (B.1.1.529) variants chronologically[6]. Because SARS-CoV-2 is an RNA virus, it is prone to mutations. The Middle East Respiratory Syndrome (MERS) outbreaks caused deaths of 37.2%[9]. The mortality rate of the Severe Acute Respiratory Syndrome (SARS) was reported to be 15%[10]. As both of these are from the coronavirus family, the COVID-19 pandemic caused serious concern worldwide. For this reason, many scientists have done especially vaccine studies on this pandemic in the literature. Alpha, Beta, Gamma, Delta, Eta, Teta, Zeta, and Omicron variants of SARS-CoV-2 were also seen in our hospital. Differences in clinical courses of the patients were observed according to the variants of the virus. While some variants caused mild illness, some were seen to cause rapid and severe illness. As the SARS-CoV-2 virus evolved, the severity and symptoms of the disease are increase[11,12]. Therefore, it aimed to investigate the outcomes of the variants in this study.

The first identification was reported to be transmitted by bats in Wuhan. When transmitted to humans from a zoonotic source, human-to-human transmission was inevitable. Unfortunately, what was feared came true, and it somehow spread across countries through coughing, sneezing, and droplet. Although mask was used to prevent respiratory contamination, the virus somehow continued to spread, causing a pandemic. It was understood that asymptomatic cases had an important role in transmission[13]. The clinical findings of COVID-19 are characterized by fever, cough, shortness of breath, and radiologically bilateral infiltrates. Severe symptomatic infection is associated with prolonged hospitalization and high mortality[14]. Patients were admitted to our clinic with similar complaints. Clinical findings vary from asymptomatic to death. The Omicron variant infects the upper respiratory tract. It multiplies faster in the bronchi than in other variants[15,16]. In our study, the disease progressed mildly in patients with Omicron variants. Mortality increased in hospitalized patients due to serious problems such as acute respiratory distress syndrome (ARDS). Septic shock and multiorgan failure were reported in some patients[17,18]. Gastrointestinal findings, myalgias, lymphopenia, and parenchymal lung abnormalities may be seen. This disease also negatively affected human psychology. In addition, COVID-19 has a high prevalence of depression, anxiety and insomnia among healthcare workers[19]. Scientists all over the world have done many scientific studies against this virus. In a study, It was reported that asymptomatic patients always recovery[20]. In this case, it was understood that more than 65% would be symptomatic. The most common symptoms of COVID-19 are cough, fever, fatigue, loss of smell and taste[21]. Cough and shortness of breath were very common in this study. In addition, leukocytosis and lymphopenia were evident. Leukocytosis was related only to the Delta variant. The more often of leukocytosis was consistent with secondary bacterial infection due to high procalcitonin. Therefore, it was thought that secondary bacterial infection might be seen more often in Delta variant. However, the Delta variant wasn't related to bacterial growth in culture. Due to the lower rate of lymphopenia, cytokine storm was rarely seen and anticytokine (tocilizumab) was used with a rate of 13.7%. However, the rate of steroid treatment was 90.3%. The use of steroids and anticytokine were related to Wuhan, Delta, and other variants statistically.

Renal dysfunction was common in patients during the pandemic. It was reported that COVID-19 causes acute renal failure (ARF)[22]. Abnormal laboratory values of the kidney were reported as 10.9%. The rate of abnormal kidney values was 14.1% in the general population in this study. ARF was 7.8%, because of being 6.3% of chronic renal failure (CRF). Treatment of dialysis was related to Wuhan type in patients without comorbidity. There was no definitive cure for COVID-19 yet. It has been reported that remdesivir and molnupiravir are used in the treatment of COVID-19[23,24]. Both weren't used in this study. Chloroquine was also used by our patients, but no significant success was detected. On the other hand, vaccine studies were done out to combat the pandemic[25,26]. The use of empirical antibiotics was recommended against secondary bacterial infections in COVID-19[27]. Empirical antibiotics were used in almost all of the patients, due to the aggressive course of the disease in the study. Despite this, the rate of leukocytosis was high without lymphocytosis. Therefore, multiple antibiotics were used. The rate of secondary bacterial infection (proven in culture) was 11.2%. Especially this rate was high in the Delta variant (16.7%), but it wasn't statistically significant.

Acute hypoxemic respiratory failure is the most common complication of COVID-19[6]. Traditional oxygen therapy may be insufficient in hypoxemia. Therefore, it was use advanced respiratory support methods such as high-flow nasal cannula (HFNC), CPAP, and invasive mechanical ventilation (IMV) in this study. Oxygen supports were done through a nasal cannula, reservoir mask, HFOT, CPAP, and intubation (most common) in this study. Oxygen support wasn't given in 18.5% of the patients, as there was no respiratory distress in room air. The absence of oxygen support was only related to the Omicron variant statistically. Omicron was the least cause of hypoxemia among all variants in the study, and it can be concluded that it didn't cause severe lung damage. The rate of intubation was 34.3% and, it was related to Wuhan and Delta variants. Management of patients with acute respiratory distress syndrome (ARDS) of COVID-19 was similar to classical ARDS. It is detected in 42% of patients presenting with COVID-19 pneumonia and in 61-81% of patients requiring intensive care. ARDS in COVID-19 is not clearly understood but, diffuse alveolar damage to the lung is similar to typical ARDS[28,29]. We frequently detected ARDS due to progressive lung damage in the study. Despite conventional treatment, ARDS was more deadly. One study reported the need for more than double the COVID-19 Intensive-care Unit capacity[30]. Intensive-care capacity increased at least 3 times in our hospital. The rate of admission of patients with COVID-19 to the Intensive-care Units was 62.1% in the study. It was reported that the length of stay in the ICU is shorter in patients with the Omicron variant[31]. In the study, the shortest stay in the ICU was Omicron and the longest was Delta variants.

COVID-19 was reported done renal damage for reasons such as viral toxicity, ischemic damage with vasculitis, and thrombosis[32]. Comorbidities were hypertension, diabetes mellitus, heart diseases, chronic renal failure respectively in this study. Postmortem examinations proved severe renal damage in COVID-19[33]. Dialysis treatment was considered important during the course of the disease due to acute renal damage caused by the virus. Dialysis treatments were already regular in patients with CRF. Therefore dialysis treatments were analyzed in patients without comorbidities (due to the direct effect of other comorbidities such as HT on renal damage). As a result, although dialysis was done in all variants, only it was statistically significant in the Wuhan type. The length of stay of the patients may vary according to many factors in the hospital. According to the length of hospital stays was 9.5 ± 0.57 days in all variants in this study. Hospital stays were Omicron, Wuhan, and Delta respectively (least to most) in statistical analyzed.

ARDS is one of the leading causes of death in COVID-19. In one study, it was reported that there was no statistical significance between ARDS seen in COVID-19 and typical ARDS mortality[34]. However, in another study, it was reported as a risk factor for ARDS in elderly patients[35,36]. Mortality rates were higher in all variants except Alpha and other variants in males patients in the study. However, there was no statistically significant between gender and mortality. Differences in comorbidities were observed in COVID-19[37,38]. All variants except Omicron were statistically related to mortality in patients with comorbidities. Delta variant was reported to have a poor prognosis. In one study, the delta variant had a higher mortality rate than alpha[39,40]. In this study, it was observed that the delta was very aggressive. Mortality was related to the Delta variant in male patients without comorbidity in the study. All patients more than 60 years of ages were related to mortality, with or without comorbidity, except for the Omicron. There was no statistically significant difference between variants except for the Omicron variant. The vaccine has been an important source of hope in the fight against the pandemic. Almost every country has launched a vaccination campaign. Many studies have shown that vaccines are successful. The effect of the vaccine decreases as the virus develops[41]. SARS-CoV-2, an RNA virus, shall continue to change its shape with mutations and cause serious health problems. Therefore, studies on therapeutic antiviral drugs need to continue.

Conclusion

The results of this retrospective study has shown that Omicron, Alpha and other variants (beta, gamma, eta, teta and zeta) of SARS-CoV-2 tend to affect the age groups 20-40, 41-60 and >60, respectively. Omicron infects females more often and other variants viz. beta, gamma, eta, teta and zeta mostly target males. Patients with comorbidities have been shown to be vulnerable to wuhan type, and the Omicron variant showed association with no comorbidities. Vaccination also has some impact. Omicron and Delta (with low evidence) variants were common among vaccinated patients, and

most of the unvaccinated patients had wuhan type. Secondary bacterial infections were related to wuhan and the delta variant. In cytokine storm treatment of Tocilizumab was more often in wuhan, delta, and Other variants. Dialysis was related to wuhan and alpha variants (with low evidence) in patients without comorbidities. Those without dyspnea were only associated with the omicron variant. Intubations were more common in wuhan and delta variants. The shortest hospital stays were in the Omicron variant and the longest in the delta variant. Mortality was related to wuhan, delta, and others variants. Alpha and omicron variants were not associated with mortality. Since, mutation is a continuous process for SARS-CoV-2 being a RNA virus, search for therapeutic antiviral drugs should also continue for effective prevention of such pandemic in future.

Conflict of Interest

Author declares no competing interests.

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