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Original Article

Triage and management of probable Covid-19 patients in the intensive care unit during the pandemic period

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Abstract

Aim: Republic of Turkey Ministry of Health dedicated our hospital as a transplant center during the pandemic period. We admitted probable Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) infection (COVID-19) cases and intensive care unit (ICU) patients from other centers, while confirmed COVID-19 cases were transferred to dedicated pandemic hospitals. The aim of this study was to determine the demographic parameters, clinical courses and outcomes of probable COVID-19 patients and to compare survivors with non-survivors admitted to our ICU.

Materials and Methods: After Ethics Committee approval, 93 patients admitted to our ICU between March 23 and May 13 were analyzed retrospectively.

Results: Mean age was 68.5y (60.2% male). Dyspnea (67.7%) was the most common symptom and hypertension (68.6%) was the most common comorbidity. None of PCR tests for SARS-CoV-2 were positive. Bilateral ground-glass (25.8%) and consolidation (14%) were the most common signs at chest computed tomography. Mean Acute Physiology and Chronic Health Evaluation System (APACHE II) score was 20.2 at ICU admission. Fifty-seven patients (61.3%) had pneumonia findings in lung X-ray or computerized tomography (CT). Thirty-four patients (36.6%) received low flow oxygen, six (9.7%) had high flow nasal oxygen and 27 (29%) had invasive mechanical ventilation. Forty patients (43%) had vasopressor therapy and 24 (25.8%) patients had renal replacement therapy due to acute kidney injury. Laboratory data including D-dimer, C-reactive protein, ferritin, creatinine kinase and procalcitonin were significantly higher in non-survivors when compared to survivors. The overall ICU mortality rate was 44.1%.

Conclusions: A triage protocol of Turkish Study of Scientific Board based on clinical, laboratory and radiological findings for probable COVID-19 patients was applied in our center during the pandemic period. So, we ensured the effective usage of scarce ICU resources. The mortality rate of probable COVID-19 patients admitted to our ICU was found to be higher than the predicted mortality rate according to their APACHE-II score.

Keywords: Coronavirus; COVID-19; intensive care unit; SARS-CoV-2; triage

INTRODUCTION

Pneumonia cases of unknown etiology in Wuhan, China's Hubei province were recognized by The World Health Organization (WHO) China Country Office on December 31, 2019 (1). The pathogen of pneumonia was detected as a novel coronavirus (2019-nCoV) that has not previously been seen in humans on January 7, 2020. The virus was denominated as Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) because of its close resemblance to SARS CoV (1-3). On January 31, 2020, the new coronavirus infection named as COVID-19 was declared as an international threat by WHO (4, 5). The mortality rate was reported as 3.8% by the WHO report of the People's Republic of China (6).

This virus has the characteristics of the beta-coronavirus subgroup in the Coronaviridae family. The mean incubation period of the virus, in which the source of infection has not yet been determined, is 5-6 days. It is transmitted by droplet and contact. It is noticed that the transmission can start 1-2 days before the symptoms and continue until the 14th day after the symptoms. Severe pneumonia, respiratory failure (acute respiratory distress syndrome [ARDS]) and / or organ dysfunctions (e.g. sepsis, septic shock, acute cardiac injury and acute renal injury) can occur (1,7). Intubation, mechanical ventilation and intensive care unit (ICU) follow-up may be required (1,7,8).

The first confirmed COVID-19 patient was detected in Turkey on March 11, 2020. After this date, the number of

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patients increased rapidly due to the ability to transmission among person to person and the disease was also confirmed in healthcare workers. Tests of 209962 people were positive for COVID-19 in Turkey and 1179 patients have been followed to the ICU as of July 9, 2020 (9).

Although the quantity and quality of ICU beds are important globally during the pandemic period, routine intensive care support should also not be interrupted for non-COVID-19 patients. ICU triage decisions are difficult during normal period and they are more difficult when resources are limited during pandemics or outbreaks. Prospective, objective protocols or algorithms may help to reduce the difficulty of triage and ensure consistency between triage decisions (10). As this process progresses, probable COVID-19 patients pose a risk to both healthcare workers and other patients. During the pandemic period, probable COVID-19 patients were admitted to an isolation ward and ICU at the Başkent University Faculty of Medicine Ankara Hospital. A triage protocol of Turkish Study of Scientific Board based on clinical, laboratory and radiological findings for probable COVID-19 patients was applied in our center (11).

In the present study, we aimed to evaluate the demographic and clinical features, complaints, comorbidities, clinical courses, real-time reverse transcriptase-polymerase chain reaction (RT-PCR) results, treatments, complications, intubation-mechanical ventilation requirement and mortality rate of the probable COVID-19 patients followed up in our ICU.

MATERIALS and METHODS

Study Design and Participants

The medical records of patients aged 18 years or more with the probable COVID-19 from March 23 to May 13, 2020 were retrospectively analyzed in our center. Patients younger than 18 years, whose data were not available and confirmed cases were excluded.

Republic of Turkey Ministry of Health dedicated our hospital as a transplant center during the pandemic period. We admitted probable COVID-19 cases and ICU patients from other centers, while confirmed COVID-19 cases were transferred to dedicated pandemic hospitals.

A total of 1964 tests were performed in our hospital, 30 were positive and a total of five solid organ transplantations, three liver and two kidney transplantations were performed in between March 23 and May 13, 2020.

This study was approved by the Baskent University Institutional Review Board (project no: KA20/197).

Data Collection

The following data were obtained from electronic medical and nursing records: patient age; sex; complaints; exposure and travel history; comorbidities; Acute Physiology and Chronic Health Evaluation System (APACHE II) score; Sequential Organ Failure Assessment (SOFA) score; Glasgow Coma Score (GCS); vital signs at ICU admission; microbiological sample type; PCR results; arterial blood gas analysis; need for intubation and mechanical ventilation (MV) (noninvasive or invasive); ventilation parameters (tidal volume, positive end-expiratory pressure [PEEP], fraction of inspired oxygen [FIO2]), arterial partial pressure of oxygen [PaO2], PaO2/FIO2 ratio; prone position; renal replacement therapy [RRT]; laboratory values; treatment (vasopressor agents, antiviral agents, antibacterial agents, corticosteroids); length of hospital-ICU stay and ICU-hospital mortality.

Laboratory Procedures

Nasal and/or oropharyngeal swab or tracheal aspirate samples of probable COVID-19 patients were performed in terms of SARS-CoV-2 in the General Directorate of Public Health Microbiology Reference Laboratory. From May 1, 2020, SARS-CoV-2 RNA have been studied in our hospital. SARS-CoV-2 was detected by RT-PCR assay. Laboratory examinations were complete blood count, D-dimer, coagulation profile, serum biochemical tests (renal and liver function tests, creatinine kinase, lactate dehydrogenase, and electrolytes), myocardial enzymes, ferritin, C-reactive protein (CRP) and procalcitonin (PCT). All patients underwent posterior anterior chest radiography (PA-CR) and chest computed tomography (CT). The intensivist decided on frequency of the examinations.

Definitions

Probable and confirmed cases were defined according to the COVID-19 guide of the Turkish Republic Ministry of Health. The criterion for admission to the ICU was evaluated according to the guide of the Ministry of Health (11,12).

Fever was defined as a tympanic measurement of 37.8°C and higher. Sepsis and septic shock were defined according to the 2020 Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with COVID-19 (13). Secondary infection was accepted when a positive culture of a new pathogen was detected at least one of respiratory tract specimens, blood, urine, wound, drain sample after ICU admission (14). Pneumonia was diagnosed on the basis to the American Thoracic Society and Infectious Diseases Society of America (ATS/IDSA) criteria (15). Acute kidney injury (AKI) was identified on the basis to the Kidney Disease Improving Global Outcomes (KDIGO) clinical practice guidelines (16) and ARDS was diagnosed according to the Berlin Definition (12,17). Disseminated Intravascular Coagulation (DIC) was defined as a cumulative score of five or more from prolonged prothrombin time (PT), reduced platelets and fibrinogen, and elevated fibrin-related markers (11,18,19).

Republic of Turkey Ministry of Health dedicated our hospital as a transplant center during the pandemic period. We admitted probable COVID-19 cases and ICU patients from other centers, while confirmed COVID-19 cases were transferred to dedicated pandemic hospitals. All patients with probable COVID-19 were isolated on a ward of the ICU.

Statistical Analysis

The statistical analysis was performed using The Statistical Package for Social Sciences 25.0 (version 25.0; SPSS Inc., Chicago, IL, USA). Frequencies were expressed as numbers (n) and percentages (%). Variables are expressed as mean values ± standard deviation. Categorical variables between the two groups were analyzed with the chi-square test. The non-parametric continuous variables between survivors and non-survivors groups were compared by Mann-Whitney test. Values of p<0.05 were considered statistically significant.

RESULTS

During the period, 21 patients were managed in the ward and 93 probable COVID-19 patients were admitted to our ICU. Out of 93 probable COVID-19 patients, 56 (60.2 %) were male and 37 (39.8%) were female. The mean age of all patients was 68.5±16.2 years (between 21 and 97 years), there was no significant difference between survivors and non-survivors. Most of the patients (61.3%, n:57) were admitted from the emergency and other wards within our hospital. Eighty-two patients (88.2%) had medical etiologies and 11 patients (11,8 %) had surgical causes. There were four renal (4.3%) and two liver (2.2%) transplant recipients. Dyspnea (67.7%) was the most common symptom and hypertension (68.8 %) was the most common comorbidity. Non-survivors had more malignancy (especially gastrointestinal system malignancy) and altered mental status than survivors. Two patients had history of exposure and none of the patients had a travel history. Twenty-two patients (23.7%) had a history of taking an Angiotensin Receptor Blockers (ARBs) or Angiotensin-Converting Enzyme inhibitor (ACEi) treatment at home. Table 1 presents the demographic and clinical characteristics of the survivors and non-survivors.

Table 1. Demographic and Clinical Characteristics of Survivors and Non-survivors

Variables	No (%)			
	Total (n:93)	Survivors (n:45)	Non-survivors (n:48)	P value
Age, years, mean ±SD	68.5±16.2	66±17.6	70.8±14.6	0.125
Range, years	(21-97)	(24-97)	(21-92)	
Sex				0.218
Male	56 (60.2)	30 (66.7)	26 (54.2)	
Female	37 (39.8)	15 (33.3)	22 (45.8)	
Etiology				0.229
Medical causes	82 (88.2)	38 (84.4)	44 (91.7)	
Surgical causes	11 (11.8)	7(15.6)	4 (8.3)	
Admission from				0.128
Emergency	28 (30.1)	17 (37.8)	11 (22.9)	
Ward in hospital	29 (31.2)	11(24.4)	18 (37.5)	
Emergency from outer center	30 (32.3)	16 (35.6)	14 (29.2)	
ICU from another center	6 (6.5)	1 (2.2)	5 (10.4)	
Transplant recipient				0.551
Renal	4 (4.3)	3 (6.7)	1 (2.2)	
Liver	2 (2.2)	1 (2.2)	1 (2.2)	
History of exposure	2 (2.2)	1 (2.2)	1 (2.2)	0.963
Comorbidities				
Hypertension	64(68.8)	34 (75.6)	30 (62.5)	0.174
Diabetes Mellitus	34 (36.6)	15 (33.3)	19 (39.6)	0.532
Cardiovascular disease	48 (51.6)	26 (57.8)	22 (45.8)	0.159
Malignancy	33 (35.5)	8 (17.8)	25 (52.1)	**0.003**
GIS malignancy	14 (15.1)	3 (6.7)	11 (22.9)	**0.016**
Symptoms				
Fever	19 (20.4)	10 (22.2)	9 (18.8)	0.678
Fatigue	31 (33.3)	16 (35.6)	15 (31.3)	0.660
Dry cough	22 (23.7)	14 (31.1)	8 (16.7)	0.101
Dyspnea	63 (67.7)	28 (62.2)	35 (72.9)	0.270
Altered mental status	30 (32.3)	8 (17.8)	22 (45.8)	**0.014**

ICU: Intensive Care Unit, GIS: Gastrointestinal system, P<.05 was considered statistically significant

Table 2. Severity scores, vital signs and measures of MV on ICU admission of Survivors and Non-survivors

		No (%)		
	Total (n:93)	Survivors (n:45)	Non-survivors (n:48)	P value
APACHE II score	20.2 ±8.3	16.6±7.4	23.5±7.7	**0.000**
SOFA score	6,6±3.4	5.3±2.6	7.9±3.6	**0.001**
GCS score	11.3±4.6	13.1±3.5	9.7±4.8	**0.001**
Temperature (°C)	36.3±1	36.4±0.9	36.2±1.2	0.606
Heart rate, beats per min	102.3±25.9	97.2±21	107±29.1	**0.017**
Respiratory rate, breaths per min	23.9±7.5	24±5.3	23.8±9.1	0.920
Mean arterial pressure, mmHg	81±23.6	88.7±19.2	73.7±25.2	**0.001**
Oxygen Saturation (%)	90.4±13.2	94.3±4.3	86.7±17.3	**0.022**
Lactate (mmol/L) on admission	2.7±2.7	1.6±1	3.6±3.4	**0.000**
Lactate on 48th hour	2.5±2.7	1.2±0.4	3.6±3.4	**0.000**
FIO_2 (%)	46±14.2	41.2±11.1	50.5±15.3	**0.001**

APACHE II: Acute Physiology and Chronic Health Evaluation System; SOFA: Sequential Organ Failure Assessment, GCS: Glasgow Coma Score, FIO2: fraction of inspired oxygen, P<.05 was considered statistically significant

Table 3. Respiratory support therapies of Survivors and Non-survivors

		No (%)		
	Total (n:93)	Survivors (n:45)	Non-survivors (n:48)	P value
P/F on admission				
>400	7 (7.5)	7 (15.6)	0	**0.011**
300-400	20 (21.5)	9 (20)	11 (22.9)	
200-300	38 (40.9)	20 (44.4)	18 (37.5)	
100-200	19 (20.4)	8 (17.8)	11 (22.9)	
<100	9 (9.7)	1 (2.2)	8 (16.7)	
Tidal Volume				
4- 8 ml/kg	45 (48.4)	11 (24.4)	34 (70.8)	**0.000**
>8 ml/kg	3 (3.2)	3 (6.7)	0	
Types of respiratoy support				
Nasal/ Mask oxygen	34 (36.6)	27 (60)	7 (14.6)	**0.000**
Nasal oxygen + NIMV	4 (4.3)	4 (8.9)	0	
IMV	27 (29)	2 (4.4)	25 (52.1)	
Nasal oxygen+ IMV	9 (9.7)	1 (2.2)	8 (16.7)	
HFOT+IMV	3 (3.2)	0	3 (6.3)	
NIMV+IMV	10 (10.8)	5 (11.1)	5 (10.4)	
Nasal oxygen+ HFOT	6 (6.5)	6 (13.3)	0	

P/F: PaO2 FiO2 ratio, NIMV: Noninvasive mechanical ventilation, IMV: Invasive Mechanical Ventilation, HFOT: High Flow Oxygen Therapy, P<.05 was considered statistically significant

COVID-19 PCR tests were performed once in 83 patients, two times in 58 patients, three times in six patients, and none of them were positive. We used 111 nasopharyngeal swab samples for the tests. PCR of Influenza type B in two patients and Respiratory Syncytial Virus (RSV) in one patient were positive.

The mean APACHE II score was 20.2 ± 8.3, GCS was 11.3 ± 4.6 and SOFA score was 6.6 ± 3.4 on ICU admission. APACHE II, SOFA scores, heart rates and lactate were higher and GCS, mean arterial pressure and oxygen saturation were lower in non-survivors than survivors (Table 2).

PaO2/FIO2 ratio was below 300 in 66 patients (70.9%). This ratio was lower in non-survivors than survivors. Thirty-four patients (36.6%) received only low flow (nasal/ mask) oxygen; six had only high flow nasal oxygen (9.7%). Forty seven patients (50.5%) required endotracheal intubation and 27 (29%) had only invasive mechanical ventilation

(IMV). Non-invasive mechanical ventilation (NIMV) was used in 14 patients (15%) (Table 3). Forty-five patients (48.3%) had ARDS, 28 patients mild, 14 patients moderate, three patients severe (Table 4). One patient (1.1 %) was followed in prone position. Recruitment maneuvers (RM) was applied to eight (8.6%) patients. The most common PEEP was 8 (5-12) cm H2O in 23 patients (24.7%). Compared with survivors, non-survivors were more likely to be intubated and developed ARDS (Table 4).

Unilateral infiltrates were present in the lung X-ray of 22 patients (23.7%) and bilateral pulmonary infiltrates in 41 (44.1%) patients. Bilateral ground-glass opacity (25.8%) and consolidation (14%) were the most common signs at chest CT. Seven patients (7.5%) had a normal chest CT at the time of admission to the ICU.

Fifty-seven (61.3%) patients had pneumonia and 38 patients (40.9%) had septic shock. Forty patients (43%) had vasopressor therapy; twenty-four patients (25.8%) only norepinephrine, eleven patients (11.8%) norepinephrine and dobutamine, 2 patients (2.2%) norepinephrine and glypressin. Methylprednisolone were administered to 47 patients (50.5%), hydrocortisone was given to 7 patients (7.5%), and dexamethasone was applied to 3 patients (3.2%). C vitamin was given to 20 patients (21.5%). Low molecular weight heparin (LMWH) 40 mg/day in 48 patients or 0.5mg /kg twice a day in 30 patients was used for thrombosis prophylaxis. Non-survivors were more likely to have septic shock, pneumonia and vasopressor therapy compared with survivors (Table 4).

RRT was performed in 24 of 33 patients (35.4%) with AKI; 23 patients (24.7%) were classified stage 1, 2 patients stage 2, 8 patients stage 3. Twenty patients received continuous renal replacement therapy (CRRT) and 14 patients received intermittent hemodialysis (IHD). Thirteen patients (14.1%) had DIC; the DIC score of 3 patients was ≥5 points and the DIC score of ten patients was < 5 points. Nobody required extracorporeal membrane oxygenation (ECMO). The frequency of complications was higher in non-survivors than survivors (Table 4).

Table 4. Treatments and Complications of Survivors and Non-survivors

Types of treatments	No (%)			
	Total (n:93)	Survivors (n:45)	Non-survivors (n:48)	P value
Azithromisin	20 (21.5)	11 (24.4)	9 (18.8)	0.500
Hydroxychloroquine	35 (37.6)	20 (44.4)	15 (31.3)	0.189
Oseltamivir	25 (26.9)	11 (24.4)	14 (29.2)	0.608
Thromboprophylaxis	80 (86)	38 (84.4)	42 (87.5)	0,485
C vitamin	20 (21.5)	10 (22.2)	10 (20.8)	0,792
Steroid	54 (58.1)	19 (42.2)	35 (72.)	**0.055**
Vasopressor therapy	40 (43)	2 (4.4)	38 (79.2)	**0.000**
RM	8 (8.6)	1 (2.2)	7 (14.6)	**0.034**
Types of shock	38 (40.9)	2 (4.4)	36 (75)	**0.000**
Septic	30 (32.3)	1 (2.2)	29 (60.4)	
Septic+ Cardiogenic	7 (7.5)	1 (2.2)	6 (12.5)	
Septic + hypovolemic	1 (1.1)	0	1 (2.1)	
Secondary bacterial infections				**0.009**
Respiratory	11 (11.9)	1 (2.2)	10 (20.9)	
Blood	19 (20.4)	7 (15.6)	12 (25)	
Urine	17 (18.3)	6 (13.3)	11 (22.9)	
Other	5 (5.5)	3 (6.6)	2 (4.2)	
Influenza type B	2 (2.2)	0	2 (4.2)	0.166
RSV	1 (1.1)	1 (2.2)	0	0.299
Pneumonia	57 (61.3)	22 (48.9)	35 (72.9)	**0.017**
ARDS	45 (48.4)	11 (24.4)	34 (70.8)	**0.000**
AKI	33 (35.5)	11 (24.4)	22 (45.8)	0.09
DIC	13 (14.1)	3 (6.7)	10 (21.3)	0.087
QT> 500 msec	2 (2.2)	1 (2.2)	1 (2.1)	0.556

RM: recruitment maneuvers, RSV: Respiratory syncytial virus, ARDS: Acute Respiratory Distress Syndrome, AKI: Acute Kidney Injury, DIC: Dissemine Intravascular Coagulation, P<.05 was considered statistically significant

Table 5. Laboratory parameters of Survivors and Non-survivors				
Laboratory values (mean ± SD)	Total (n:93)	Survivors (n: 45)	Non-survivors (n: 48)	P value
Leukocyte (10^3/µl)	13.6±8	11.7±4.7	15.3 ± 9.9	0.294
Lymphocyte (10^3/µl)	1.2±0.8	1.2 ± 0.8	1.2 ± 0.9	0.477
NLR (%)	15.7±21.6	12.7± 14.8	18.6 ± 26.4	0.063
D-dimer (mg/L)**	6±8.4	3.8 ±4.5	8.1±10.4	**0.013**
CRP (mg/dl) **	104.4±94.2	66 ± 60.1	140.3 ± 106	**0.000**
Procalcitonin (ng/ml)**	4.5±14	1.2±2.7	7.5 ±19.0	**0.008**
Ferritin (µg/L)**	969.5±1623.6	631.3±802.4	1290.4±2091.8	**0.026**
CK (U/L)**	141.9±337.2	82.1± 115.8	198.6±452.8	**0.004**

**Statistical significance was considered as a p value <0.05 between groups. NLR: Neutrophil lymphocyte ratio, CRP: C-reactive protein, CK: Creatine kinase, SD: Standard Deviation

Table 6. Length of Stay and Outcomes of Patients				
		Mean ±SD		
	Total (n:93)	Survivors (n:45)	Non-survivors (n:48)	P value
Intubation time	1.4±2.2	0.4±1.1	2.4±2.5	**0.000**
Duration of MV	1.9±2.9	1±2.1	2.8±3.3	**0.000**
LOS at ICU	4.4±4	4.2±3.1	4.6±4.8	0.501
LOS at Hospital	16.6±43.8	14.7±21.7	18.4±57.5	0.336
Mortality rate				
ICU	41 (44.1)	1 (2.2)	40 (83.3)	**0.000**
Hospital	49 (52.7)	1 (2.2)	48 (100)	**0.000**

MV: Mechanical ventilation, LOS: length of stay, ICU: Intensive care unit, P<.05 was considered statistically significant

Plaquenil was given to 35 (37.6%) patients. Azithromycin was administered to 20 (21.5 %) patients and oseltamivir was administered to 25 (64.5 %) patients for maximum 10 days. Eight patients (8.6%) did not receive any antibiotic treatment. If necessary, empirical antibiotic therapy was revised according to results of microbiological culture during the ICU stay. Secondary bacterial infections were detected among 52 patients (55.9%) and more common in non-survivors. No patient was given favipiravir, remdesivir or tocilizumab in the ICU.

Laboratory data including D-dimer, CRP, ferritin, creatine kinase and PCT were significantly higher in non-survivors when compared to survivors (Table 5).

While 49 patients (52.7%) were transferred to the ward, three patients (3.2%) were discharged home from the ICU. Forty-four patients (47.3%) were discharged from the hospital. The intubation time and duration of MV were longer in non-survivors than survivors. The mean length of stay in ICU and hospital were 4.4± 4.0 and 16.6 ±43.8 days. The overall ICU mortality rate was 44.1% and hospital mortality rate was 52.7% (Table 6).

DISCUSSION

In this study, we admitted 93 probable COVID-19 patients to the ICU of our hospital as a transplant center during the pandemic period. We detected that the need for intubation and mechanical ventilation in probable COVID-19 patients is associated with high morbidity and mortality. Hereby, the severity of pulmonary dysfunction among COVID-19 patients admitted to the ICU is associated with poor prognosis. In our study cohort, most of the patients (60.2%) were male and the mean age was over 65 years. The population of other studies in the literature consisted mostly of men and older patients (2,3,6,20-22). So, age and male gender may be risk factors.

We reported that hypertension was the most common comorbidity, followed by cardiovascular diseases. A similar rate was stated in previous studies (2,3,6,20,22,23). Malignancy was also frequently observed in non-survivors like other reports (1,6,21).

Dyspnea was defined in 67.7 % of the patients on admission to the ICU, followed by fatigue and cough. Altered mental status was more common in non-survivors than survivors. But, fever was reported as the most common complaint (3,21,22,24). We think that altered mental status due to hypoxemia is commonly seen in older patients compared with younger patients. In this study, non-survivors had more hypoxemia so, more altered mental status was observed among these patients.

In this study, APACHE II and SOFA scores at ICU admission were significantly higher in non-survivors and GCS score

was lower in non-survivors than survivors. The scores indicate that this ratio is associated with the severity and prognosis of disease. Tachycardia, hypotension and hyperlactatemia were reported more frequently in non-survivors. These findings were similar to studies reported (21,22).

The PaO2/FiO2 ratio corresponds to the severity of ARDS and it is correlated with increased mortality by the Berlin definition (17). In our study, this ratio was lower in non-survivors than survivors. Endotracheal intubation and IMV were required in 50.5 % and 52.6% of the patients, whereas NIMV was used in 15%. The need of endotracheal intubation in our study was higher than other studies: 30%, 47% and 42% respectively (1,6,21). But, Grasselli et al. reported a higher rate (88%) than our study (2). The use of NIMV was detected between 19-62% in other studies (1,6,21,25). The use of NIMV was lower when compared to other studies because most of our patients had ARDS with severe hypoxemia and altered consciousness. Compared with survivors, non-survivors received more IMV. The intubation time and duration of MV were longer in non-survivors than survivors. It could be due to the severe hypoxemia with IMV requirement.

RM can be considered in COVID-19 related ARDS patients whose hypoxemia continues despite optimal ventilation (17,26). In this study, we applied the RMs more in non-survivors than survivors, because, these patients had more severe hypoxemia and ARDS.

Huang et al. reported ARDS in 85% of patients admitted to ICU (1) and Yang et al. found in 67% (21). We found that 48.4% of patients had ARDS. Zhou et al. reported that ARDS was more observed in non-survivors (22). Compared with survivors (24.4%), non-survivors (70.8%) were more likely to develop ARDS in our study.

COVID-19 has been identified as viral sepsis. So, sepsis and septic shock were common complications of COVID-19. Zhou et al. found that more than half of patients developed sepsis (22). In our study, we reported that 38 patients (40.8%) had septic shock which was more frequent among non-survivors (75%) when compared to survivors (4.4%). The critically ill COVID-19 patients have a high risk of secondary infections due to prolonged and severe course of the disease and immunosuppression (26). In this study, the frequency of pneumonia and secondary bacterial infections were higher in non-survivors than survivors.

Although pulmonary complications are the main features of COVID-19, the damage of the kidney and other organs function can be observed. In our study, 33 of total patients (35.5%) and 45.8% of non-survivors had AKI. Yang et al (21) found that 29% of patients had AKI. Early clinical trials report that AKI develops in approximately 15% of in-patients and 50% of non-survivors for COVID-19 (22,27). So, we thought that AKI may be related to poor prognosis in COVID-19.

In our study, 43% of the patients were given vasopressor therapy and more than half were given systemic corticosteroids like previous studies (21). These treatments were applied more frequently in non-survivors since most of our patients had ARDS and septic shock. Although usage of systemic corticosteroids is controversial for COVID-19, there are clinical trials that recommend corticosteroids due to cytokine storm and hyperinflammation (13,26,28-30).

Thromboembolic events are particularly frequent in COVID-19. Although the best therapy of thromboprophylaxis is not clear for COVID-19, the use of unfractionated heparin and LMWH is recommended (11,31). LMWH was applied in 83.9% of the patients for thromboprophylaxis according to recommendations of the guidelines.

At this time, the use of therapeutic agents in the treatment of COVID-19 is controversial, as there are currently no randomized controlled trials (30,32,33). No patient was given favipiravir, remdesivir or tocilizumab and we administered azithromycin, hydroxychloroquine and oseltamivir therapy among our patients.

Laboratory data including D-dimer, CRP, ferritin, creatinine kinase and PCT were significantly higher in non-survivors when compared to survivors similar to other reports (6,20,21,22,24).

Previous studies reported different mortality rates in patients requiring ICU admission from 16% to 38%, 62%, 67% and 78% (6,1,21,25,22). In this study, while 52.7% of patients were transferred to the ward, 3.2% had been discharged home from the ICU. The overall ICU mortality rate was 44.1% and hospital mortality rate was 52.7%. The mortality rate was higher due to older age and comorbidities of our patients.

Republic of Turkey Ministry of Health dedicated our hospital as a transplant center during the pandemic period. We admitted probable COVID-19 cases and ICU patients from other centers, while confirmed COVID-19 cases were transferred to dedicated pandemic hospitals. So, this study is the only trial evaluating only probable cases.

ICU triage of patients is challenging and controversial during pandemic period when resources are overwhelmed (10,31,34). We had some difficulties during the ICU management and triage. We accepted the patients with negative COVID-19 from other centers but, radiologists in our hospital detected radiological findings of COVID-19 at the CT of same patients. So, the patients were admitted to the cohort ICU. There were differences between departments of infectious diseases and clinical microbiology and chest diseases in diagnosis and management of COVID-19 patients. We had scarce ICU beds. Solid organ transplantations and elective surgeries were continued in our hospital. Therefore, there were difficulties in terms of the usage of ICU beds.

LIMITATIONS

This study has some limitations. It was a retrospective, small study. It was conducted at a single center, which limits the generalizability of the results. The data were

collected from the digital patient records. Not all laboratory tests were done in all patients.

CONCLUSION

A triage protocol of Turkish Study of Scientific Board based on clinical, laboratory and radiological findings for probable COVID-19 patients was applied in our center during the pandemic period. So, we ensured the effective usage of scarce ICU resources. The mortality rate of probable COVID-19 patients admitted to our ICU was found to be higher than the predicted mortality rate according to their APACHE-II score.

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