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Letter to the editor

Characteristics of critically ill patients infected with COVID-19 in Abu Dhabi, United Arab Emirates

Dear Editor,

Since December 2019, a novel coronavirus SARS-CoV-2 emerged in Wuhan city and extended around the globe. As of June 26, 2020, approximately 46,563 confirmed cases have been documented in the United Arab Emirates (UAE), with 308 deaths [1].

There are no reports describing patients admitted to the intensive care unit (ICU) with COVID-19 in the UAE. This study's primary objective was to describe the clinical characteristics of patients with laboratory-confirmed COVID-19 admitted to the ICU at Cleveland Clinic Abu Dhabi.

A retrospective study was conducted for this purpose. A waiver of informed consent was obtained from the Ethics Committee at Cleveland Clinic Abu Dhabi (number: A-2020-035). All consecutive adult patients admitted to our ICU between March 31 and May 10, 2020, with confirmed SARS-CoV-2 infection (virus detected by a real time reverse transcriptase–polymerase chain reaction assay of a nasopharyngeal sample) were included. De-identified data from the electronic medical record were collected: comorbidities, laboratory data at ICU admission, arterial blood gas and respiratory mechanics data on admission and during the first 3 days. Continuous variables are expressed as mean ± SD or as median [interquartile range], and proportions were used for categorical variables.

From March 31 to May 10, 2020, 508 adult patients with COVID-19 infection were admitted to the hospital. Among them, 55 patients (11%, 51 males) required ICU admission and were included in this study (Fig. 1). The main characteristics of the cohort are summarised in Table 1. Twenty-eight patients (51%) had at least one comorbidity. Diabetes and hypertension were the most common comorbid conditions (38% and 36%, respectively). At ICU admission, all patients had bilateral infiltrates on chest X-ray, and 24 patients (44%) experienced fever.

On admission to ICU, lymphocytopenia was common (73%). Ferritin, C-reactive protein, and interleukin-6 were all elevated (Table 1). The median initial PaO_2/FiO_2 ratio was 82 [64–128] mmHg and improved on day 3.

Forty patients (73%) required mechanical ventilation (MV) (Fig. 1). The median initial tidal volume was 6.5 [5.8–7.0] mL/kg predicted body weight and the median initial positive end-expiratory pressure (PEEP) was 12 [12–14] cmH_2O. Neither value changed during the first 3 days. Thirty-three patients (82%) had a plateau pressure < 30 cmH_2O on day 1, and 38 (95%) on day 3 (Table 1). The median driving pressure on day 1 of MV was 16 [13–18] cmH_2O, and 14 cmH_2O on day 3, with 24 patients (60%) having a driving pressure ≤ 15 cmH_2O. The mean static pulmonary compliance (Crs) was 28.0 ± 9.3 mL/cmH_2O on day 1 and did not improve during the first 3 days of MV (Table 1). A Crs > 40 mL/cmH_2O was observed in 4 patients (10%) on day 1, 3 patients (7%) on day 2, and 5 patients (12%) on day 3.

The median PaO_2/FiO_2 in the 15 patients treated with high-flow nasal cannula (HFNC)/non-invasive ventilation (NIV) and did not require MV was 89 [54–156] mmHg at ICU admission. Also, in these patients, the mean respiratory rate was 37 ± 7 breath/min at ICU admission. As of June 20, 2020, 43 patients were alive (mortality rate: 22%); among them, 34 (79%) were discharged from the hospital (Fig. 1).

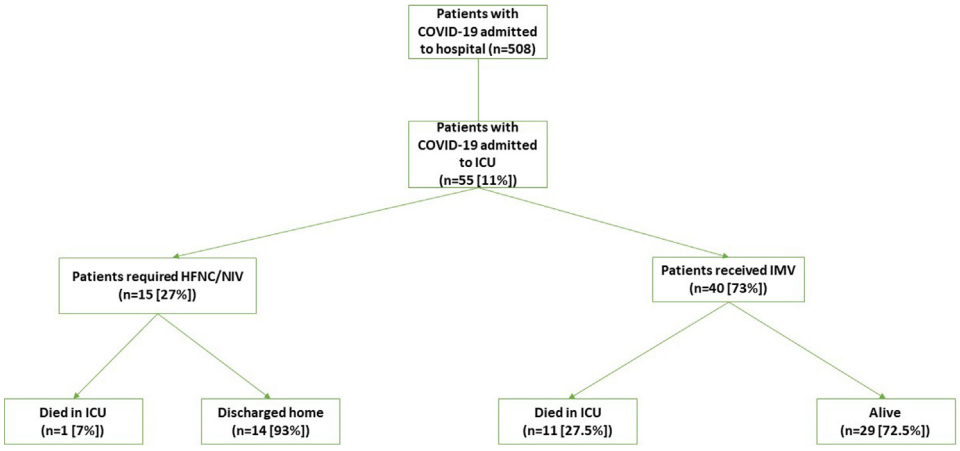

Fig. 1. Flow chart of COVID-19 patients admitted to intensive care unit (ICU) and their outcomes. NIV: Non-invasive ventilation; HFNC: high-flow nasal cannula.

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Table 1
Baseline clinical characteristics, laboratory, respiratory mechanics, and imaging findings (n = 55).

Age, y	51 ± 13
Age ≥ 65 y, n (%)	7 (13)
Weight, kg	76 [67–84]
Body mass index (BMI), kg/m^2	26.0 [24.0–29.5]
BMI > 35 kg/m^2, n (%)	5 (9)
Male, n (%)	51 (91)
Admission location, n (%)	
Emergency department or wards	26 (47)
Referrals from outside hospitals	29 (53)
Comorbidities, n (%)	
Chronic obstructive pulmonary disease	1 (2)
Asthma	3 (5)
Hypertension	20 (36)
Diabetes mellitus	21 (38)
Coronary artery disease	5 (9)
Chronic kidney disease	2 (4)
Cancer	1 (2)
Immunosuppressive treatment	1 (2)
Duration of symptoms before ICU admission, day	5 [3–7]
Vital signs on ICU admission	
Temperature, °C	37.9 ± 1.0
Temperature > 38 °C, n (%)	24 (44)
Heart rate, beats/min	105 ± 19
Heart rate > 100 beats/min, n (%)	31 (56)
Respiratory rate, mean ± SD (range), breaths/min	34 ± 8 (14–49)
Respiratory rate > 20 breaths/min, n (%)	53 (96)
Mean arterial pressure, mmHg	70 [65–81]
Laboratory data on ICU admission	
Haemoglobin, g/dL	13.3 ± 2.3
Leucocytes, per mm^3	8175 [5960–11280]
Lymphocytes, per mm^3	740 [475–1102]
Lymphocytes ≤ 1000/mm^3, n (%)	40 (73)
Neutrophils, per mm^3	7220 [4762–9415]
Platelet count, per mm^3	210 [151–273]
C-reactive protein, mg/L	185 ± 119
Procalcitonin, ng/mL	0.56 [0.21–2.28]
Ferritin, μg/L (reference range: 36—480)	1515 [750–2869]
Interleukin-6, ng/L	311 [1230–1602]
INR	1.2 [1.1–1.3]
Activated partial thromboplastin time	36.5 ± 4.9
D-dimer, μg/mL (normal reference: < 0.5)	1.95 [0.91–4.00]
D-dimer > 3.00 μg/mL (6 times the normal upper limits), n (%)	19 (34)
Fibrinogen, g/L	6.44 [5.63–7.27]
Alkaline phosphatase, IU/L	69 [52–101]
Alanine aminotransferase, IU/L	39 [27–81]
Aspartate aminotransferase, IU/L	58 [38–91]
Bilirubin, μmol/L (reference range: 5–21)	12.0 [7.3–18.2]
Creatinine, μmol/L	81.5 [66.0–115.2]
Albumin, g/L	33 [29–36]
NT-proBNP, ng/L	242 [69–1284]
Troponin, μg/L	0.014 [0.01–0.034]
Lactate, mmol/L	1.35 [1.22–1.71]
Lactate > 1.5 mmol/L, n (%)	16 (29)
Lowest PaO_2/FiO_2 ratio, mmHg	
Day 1	82 [64–128]
Day 2	94 [68–126]
Day 3	108 [73–162]
Characteristics of mechanical ventilation, n = 40	
Day 1	
Tidal volume, median [IQR], mL/Kg PBW	6.5 [5.8–7.0]
Plateau pressure, median [IQR], cmH_2O	28 [26–30]
Plateau pressure ≤ 30 cmH_2O, n (%)	33 (82)
Positive end expiratory pressure, median [IQR], cmH_2O	12 [12–14]
Driving pressure, median [IQR], cmH_2O	16 [13–18]
Driving pressure ≤ 15 cmH_2O, n (%)	18 (45)
Static compliance, median [IQR], mL/cmH_2O	28.0 ± 9.3
Day 2	
Tidal volume, median [IQR], mL/Kg PBW	6.6 [6.0–7.0]
Plateau pressure, median [IQR], cmH_2O	28 [26–30]
Plateau pressure ≤ 30 cmH_2O, n (%)	36 (90)
Positive end expiratory pressure, median [IQR], cmH_2O	12 [12–14]
Driving pressure, median [IQR], cmH_2O	15 [13–18]
Driving pressure ≤ 15 cmH_2O, n (%)	23 (57)
Static compliance, median [IQR], mL/cmH_2O	28.2 ± 8.2
Day 3	
Tidal volume, median [IQR], mL/Kg PBW	6.3 [5.6–7.0]
Plateau pressure, median [IQR], cmH_2O	27 [24–29]
Plateau pressure ≤ 30 cmH_2O, n (%)	38 (95)
Positive end expiratory pressure, median [IQR], cmH_2O	12 [10–13]
Driving pressure, median [IQR], cmH_2O	14 [13–17]
Driving pressure ≤ 15 cmH_2O, n (%)	24 (60)
Static compliance, median [IQR], mL/cmH_2O	29.7 ± 9.2
Chest radiography findings on ICU admission, n (%)	
Clear	0 (0)
Unilateral infiltrates	0 (0)
Bilateral infiltrates	55 (100)
Pleural effusion	1 (2)

ICU: intensive care unit; PaO_2: partial pressure of arterial oxygen; FiO_2: fraction of inspired oxygen; NT-proBNP: N-terminal prohormone brain natriuretic peptide. Data are presented as median [interquartile range], mean ± standard deviation, or count (percentage).

Unlike patients in the previous reports from the different parts of the world, our patients were younger and mostly men (91%) [2]. However, diabetes and hypertension were the most common comorbidities [2,3]. Forty-four percent had a fever at ICU admission, in line with what was observed previously [2], but much lower than in other studies [4]. Lymphocytopenia was common at ICU admission, as observed in previous findings [2].

All patients had bilateral infiltrates on the chest X-ray, and most of them were severely hypoxemic. Also, all inflammatory markers were elevated at ICU admission (Table 1). These findings are suggestive of severe COVID-19 infection-induced cytokine release syndrome.

Gattinoni et al. [5] proposed the presence of two "phenotypes" of COVID-19 pneumonia. Type-L [atypical acute respiratory syndrome (ARDS)], characterised by low elastance, low ventilation to perfusion (V_A/Q) ratio, low lung weight, and low recruitability; Type-H (typical ARDS), characterised by high elastance, high right-to-left shunt, high lung weight, and high lung recruitability. In our cohort, 15 patients (27%) were treated with HFNC/NIV ventilation and did not require MV (Fig. 1). These patients presented with severe hypoxemia, had bilateral chest X-ray infiltrates and were tachypnoeic, suggesting severe COVID-19 pneumonia; still, they did not appear overtly dyspnoeic and were breathing comfortably. These patients had probably a type-L COVID-19 pneumonia. In these patients, hypoxemia is mainly due to V_A/Q mismatch resulted from the loss of hypoxic pulmonary vasoconstriction and impaired regulation of pulmonary blood flow [5]. The good outcomes observed (Fig. 1) might suggest that some of the severely hypoxemic COVID-19 patients without increased work of breathing can be managed without the use of intubation and MV. However, further studies are needed to assess whether the benefits from such an approach outweigh the known costs of prolonged sedation, paralysis, and MV required to achieve reduced mechanical power in these patients. In any case, these patients should be closely monitored, and clinical signs of marked air hunger and vigorous ventilatory efforts should be carefully scrutinised. If increased work of breathing is present, intubation and protective lung mechanical ventilation should be strongly considered to avoid the development of patient self-inflicted lung injury resulted from the generation of high transpulmonary pressure.

The majority of our mechanically ventilated patients had low compliance (< 40 mL/cmH_2O) during the first three days of MV (Table 1), suggesting that these patients had a type H COVID-19 induced ARDS, as proposed by Gattinoni et al. [5]. These patients were managed with low tidal volume, moderate/high PEEP, and plateau pressure < 30 cmH_2O (Table 1) similar to those in populations of patients with typical ARDS. Our results are in line

with previous findings [2] that reported low Crs in COVID-19 induced ARDS.

In conclusion, the majority of patients were younger males; a large proportion had typical ARDS and received MV.

Compliance with ethical standards

The study was approved by the Clinical Research Ethics Committee of Cleveland Clinic Abu Dhabi (number: A-2020-035) and consent was waived due to the observational nature of the study.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to privacy (patients' data) but are available from the corresponding author on reasonable request.

Authors' contributions

The study was designed by JM. JM enrolled patients and is responsible for the integrity of data. JM, KA, and SS collected data. Data analysis was performed by JM, FH and NR. JM wrote the first draft of the manuscript. All authors contributed scientifically in the subsequent versions. All authors read and approved the final manuscript.

Disclosure of interest

The authors declare that they have no competing interest.

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