Research Article

Outcomes of Critically Ill COVID-19 Positive Cases Admitted at ICU in a COVID-19 Referral Hospital, Dhaka, Bangladesh

Mohammad Anarul Islam[1], Sanjana Asma[2], Muhammad Salah Uddin[3], S M Sadlee[4], Mohammad Shukur Ali[5], Mohammad Zaforullah Chowdhury[6]

Abstract

Introduction: The initial case of coronavirus disease (COVID-19), triggered by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in December 2019. The disease swiftly spread, infecting millions globally and significantly challanged healthcare systems. As per the World Health Organization, approximately 5% of COVID-19 patients who were severely or critically ill require intensive care unit (ICU) admission.

Objective: This study aimed to evaluate the treatment outcomes of critically ill COVID-19-positive patients admitted at ICU in a COVID-19 referral hospital.

Method: This descriptive, retrospective study was conducted in the Department of Respiratory Medicine, in collaboration with the Department of Virology and the COVID unit at Anwer Khan Modern Medical College Hospital, Dhanmondi, Dhaka, Bangladesh, from December 2023 to May 2024.

Results: Among the 100 critically ill COVID-19-positive patients, the most common age group was 54-68 years, with a mean age of 59.83±13.07 years and a median age of 58. The majority of the patients were male (70%). The most frequent comorbidities were diabetes (60%) and hypertension (44%). The predominant clinical presentations included shortness of breath (75%) and fever (66%). The mean levels of CRP, D-dimer, WBC, and ferritin were 112.70±76.85 mg/L, 3.16±0.09 ng/L, 21382±14880.12 cells/uL, and 1402.46±921.46 ng/L, respectively. The study observed a low mortality rate (7%) and a high survival rate (93%) among critically ill COVID-19-positive patients in the ICU. The majority of deaths (6%) occurred in the age group over 69 years, with males being predominant (5%).

Conclusion: This study found a low mortality rate (7%) and a high survival rate (93%) among critically ill COVID-19-positive patients in the ICU. Hence, the national guidelines of Bangladesh and the World Health Organization (WHO) guidelines for the clinical management of critically ill COVID-19 patients were effective and standard for the management of critically ill COVID-19 cases in Bangladesh.

Introduction

The first coronavirus disease (COVID-19), caused by severe acute

Affiliation:

[1]Consultant, Department of Respiratory Medicine, National Health Service (NHS), London, UK.

[2]Faculty of Health Science, Department of Public Health of the University of Sunderland, London, UK.

[3]Associate Professor, Department of Neurology, Chittagong Medical College, Chattogram, Bangladesh

[4]Associate Consultant, Stroke Centre, United Hospital Limited, Dhaka, Bangladesh.

[5]Professor, Department of English, University of Development Alternative (UODA), Dhaka, Bangladesh.

[6]Principal, East West Medical College, Uttara, Dhaka, Bangladesh.

*Corresponding author:
Dr. Md. Anarul Islam, Consultant, Department of Respiratory Medicine, National Health Service (NHS), London, UK

respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in December 2019. The virus rapidly spread, leading to millions of infections worldwide and posing a major challenge for healthcare systems [1]. Common symptoms observed in COVID-19 patients encompass fever, dry cough, fatigue, headache, vomiting, diarrhea, difficulty breathing, muscle pain, acute respiratory distress syndrome (ARDS), and shock [2]. Research indicates that those requiring intensive care are typically older, mostly male, with around 40% having underlying health issues including diabetes, heart diseases, hypertension, asthma, and chronic conditions such as liver or kidney disease [3, 4]. While numerous COVID-19 cases are mild or asymptomatic, a considerable portion progress to moderate or severe pneumonia necessitating ICU admission [5]. The surge in COVID-19 hospitalizations overwhelmed emergency departments and ICUs, leaving many countries unable to supply sufficient beds and ventilators for patients experiencing acute respiratory distress [6]. Although there are numerous reports on critically ill patients [7-9], there remains limited understanding of the clinical trajectory, outcomes, and interventions among ICU admissions. Due to variations in study design, patient population, and geographic locations, ICU admission rates vary widely from 4.0% to 32% [10, 11], and mortality rates from 0.7% to 52.4% in COVID-19 positive cases [12]. Patients with severe COVID-19 often present with multiorgan failure, necessitating life-sustaining interventions [13]. The global COVID-19 pandemic has placed significant strain on healthcare systems worldwide, particularly in Bangladesh, which faces unique challenges including high population density and limited healthcare infrastructure. Despite World Health Organization reports indicating that approximately 5% of severe COVID-19 cases require ICU care, Bangladesh has one of the lowest ICU bed capacities per 10,000 residents [14] This situation highlights the need to understand how the healthcare system, with its limited resources, is managing critically ill COVID-19 patients. Health and governmental authorities need to comprehend the clinical characteristics and results of severely ill COVID-19 patients to anticipate the demand for ICU resources and plan for future COVID-19 waves in Bangladesh. Thus, this study aimed to assess the treatment outcomes of critically ill patients with COVID-19 admitted to an ICU at a designated COVID-19 hospital.

Methods

This retrospective descriptive type of study was conducted at the Department of Respiratory Medicine, in collaboration with the Department of Virology and the COVID Unit at Anwer Khan Modern Medical College Hospital, Dhanmondi, Dhaka, Bangladesh, from December 2023 to May 2024. Formal approval was obtained from the Director of the hospital. A purposive consecutive sampling technique was used and a total of 100 confirmed COVID-19 positive

critically ill patients, regardless of age and sex, treated in the ICU following the clinical management guidelines set by the World Health Organization (WHO) and the Bangladesh National Guidelines for Clinical Management of COVID-19 Positive Cases-2020 [14, 15], were retrospectively included in this study. Data were collected from the hospital registry and case report files using a pre-structured questionnaire and a Case Record Form (CRF). The collected data underwent processing, refinement, and entry into a computerized system for analysis. Statistical analysis utilized the Statistical Package for the Social Sciences (SPSS) software, version 23.0.

Inclusion criteria:

1. Severe COVID-19 cases confirmed through RT-PCR laboratory testing
2. Any age
3. Admitted to ICU
4. Complete information available in the hospital registry
5. Complete diagnosis reports in the case record
6. Clear and comprehensive treatment outcome comments in the case record

Exclusion criteria:

1. COVID-19 negative cases confirmed by RT-PCR lab test
2. Incomplete information in the hospital registry
3. Incomplete diagnosis reports in the case record
4. Missing treatment outcome comments in the case record

Results

Table 1: Baseline characteristics of critically ill COVID-19 positive cases (n=100).

Age in years	Frequency	Percent
<38	2	2
39-53	31	31
54-68	47	47
69-83	12	12
84-105	8	8
Total	100	100
Mean age(years)	59.83±13.07	
Median	58	
Mode	62	
Range	38-105	
Sex distribution		
Male	70	70
Female	30	30
Total	100	100
Residence distribution		

Urban	87	
Rural	13	
Total	100	100
Socio-economic condition		
Upper class	85	85
Middle class	10	10
Lower class	5	5
Total	100	100

Table 1 presents the baseline characteristics of the study subjects. The majority of patients, 47 (47%), were in the 54–68-year age group, followed by 31 (31%) in the 39–53-year range, 12 (12%) in the 69–83-year range, 8 (8%) in the 84-105 year range, and 2 (3%) under 38 years. The mean age was 59.83±13.07 years, with a median of 58 years, a mode of 62 years, and an age range of 38-108 years. Among the patients, 70 (70%) were male and 30 (30%) were female. Most patients, 87 (87.5%), resided in urban areas, while 13 (13.5%) were from rural areas. Socioeconomically, 85 (85%) patients were from the upper class, 10 (10%) from the middle class, and 5 (5%) from the lower class.
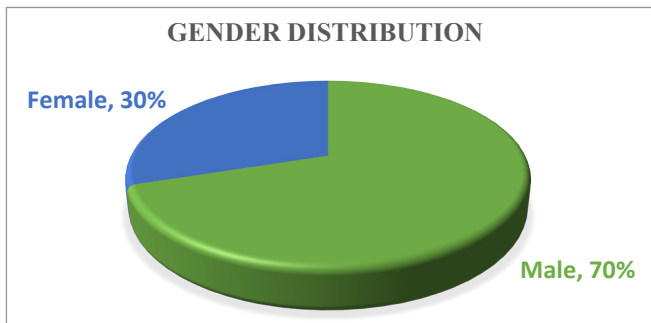
GENDER DISTRIBUTION

Female, 30%

Male, 70%

Figure 1: Gender distribution of the study patients (n=100).

Table 2: Distribution of co-morbidities associated with the study subjects (n=100).

Co-morbidities	Frequency	Percent
Hypertension(HTN)	44	44
Diabetes Mellitus(DM)	60	60
Cardio vascular disease (CVD)	1	1
Chorionic Kidney Disease(CKD)	7	7
Hypothyroid	4	4
Stenting	1	1
Hypokalamia	4	4
Chronic obstructive pulmonary disease(COPD)	6	6
Bronchial Asthma	13	13
Benign prostatic hyperplasia(BPH)	3	3
Benign enlargement of the prostate(BEP)	5	5
Ischemic heart disease (IHD)	21	21
Non-ST-elevation myocardial infarction(NSTEMI)	9	9

Table-2 shows the distribution of associated co-morbidities of the study subjects The most frequent associated comorbidity was observed to be diabetes mellitus(DM) 60 (60%) followed by hypertension (HTN), 44(44%), ischemic heart disease (IHD) 21(21%),bronchial asthma 13(13%),non-ST-elevation myocardial infarction (NSTEMI) 9 (9%),chronic kidney disease (CKD) 7 (7%), chronic obstructive pulmonary disease (COPD) 6 (%6), benign enlargement of the prostate (BEP) 5 (5%) , hypothyroid 4(4%), hypokalemia 4 (4%), benign prostatic hyperplasia (BPH) 3(3%) cardio vascular disease (CVD) 1(1%), stenting 1(1%).

Table 3 details the clinical presentations of the study subjects. In critically ill COVID-19 positive cases, the most common symptom was shortness of breath (75%), followed by fever (66%), cough (50%), acute respiratory distress (17%), lower respiratory tract infection (2%), and chest pain (2%).

Table-3: Clinical presentation of critically ill COVID-19 positive cases (n=100).

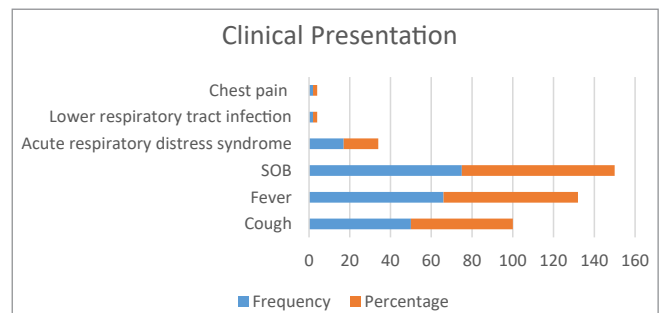| Clinical Presentation	Frequency	Percentage
Cough	50	50
Fever	66	66
SOB	75	75
Acute respiratory distress syndrome	17	17
Lower respiratory tract infection	2	2
Chest pain	2	2

Figure 2: Clinical presentation of critically ill COVID-19 positive cases (n=100).

Table-4 shows the distribution of laboratory parameters of the study subjects. The most frequent COVID-19 detective markers were observed to be mean c-reactive protein (CRP) 112.70 mg/L with a standard deviation of 76.85 mg/L ranges from 1.40 mg/L to 31.3 mg/L followed by D-dimer 3.16 ng/mL with a standard deviation of 0.09 ng/mL ranges from 0.05 ng/mL to 10.50 ng/mL, procalcitonin (PCT) 2.30 ng/mL with a standard deviation of 2.61 ng/mL, ranges from 0.05 ng/mL to 10 ng/mL, white blood cell (WBC) 21382 cells/µL with a standard deviation of 14880.12 cells/µL ranges from 1545

cells/µL to 87651 cells/µL, lactate dehydrogenase(LDH) 500.75 U/L with a standard deviation of 189.83 U/L ranges from 102 U/L to 962 U/L and ferritin 1402.46 ng/mL with a standard deviation of 921.46 ng/mL ranges from 47.30 ng/mL to 5267 ng/mL

Table 4: Laboratory parameters of critically ill COVID-19 positive cases (n=100).

Laboratory parameters	(Mean± SD)	Minimum	Maximum
Systolic BP	133.11±19.71	100	200
Diastolic BP	81.14±11.59	60	130
Hb%	9.31±5.12	6	88
CRP	112.70±76.85	1.4	31.3
D-dimer	3.16±0.09	0.05	10.5
Temperature (°F)	100.51±1.79	98	104
Respiratory Rate	91.96±18.99	51	167
Oxygen Saturation (%)	92.26±6.03	60	99
Creatinine	1.31±0.71	0.7	3.41
PCT	2.30±2.61	0.05	10
WBC	21382±14880.12	1545	87651
LDH	500.75±189.83	102	962
Ferritin	1402.46±921.46	47.3	5267
Na	147±16.14	123	193
K	3.77±0.94	0.7	6.9

Table-5 shows the treatment outcome of COVID-19 positive critical cases in ICU. Among the 100 critical COVID-19 positive cases, 93(93%) were discharged alive, while 7(7%) cases resulted in death during the treatment at ICU.

Table 5: Treatment outcome of critically ill COVID-19 positive cases at ICU (n=100).

| Treatment outcome	Frequency	Percent
Discharge alive	93	93
Discharge dead	7	7
Total	100	100

Table 6 displays the age and gender distribution of deceased cases among the study subjects. For critically ill COVID-19 positive patients, the highest mortality was observed in the age groups of 69-83 years and 84-105 years, each accounting for 3% of the deaths, followed by the 54–68-year age group with 1%. Male patients had a higher mortality rate, with 5% of the deaths, while female deaths accounted for 2% of the total cases.
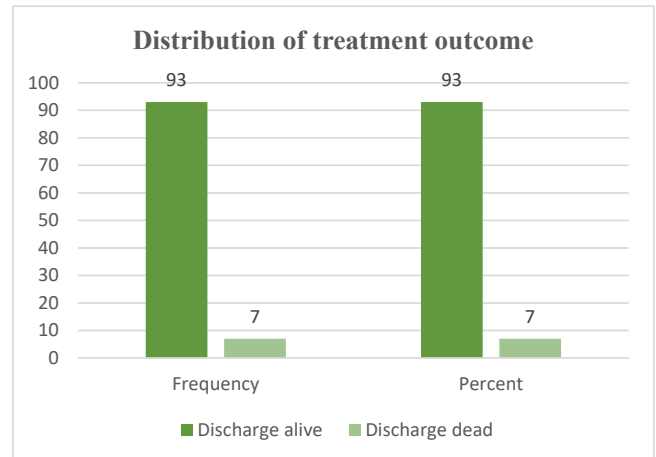
Figure 3: Distribution survival and death cases of the study patients (n=100).

Table 6: Age and gender distribution of dead cases (n=7).

Age(years)	Frequency	Percent
<38	0	0
39-53	0	0
54-68	1	1
69-83	3	3
84-105	3	3
Gender		
Male	5	5
Female	2	2

PROPORTION OF DEATH CASES

Female, 2%

Male, 5%
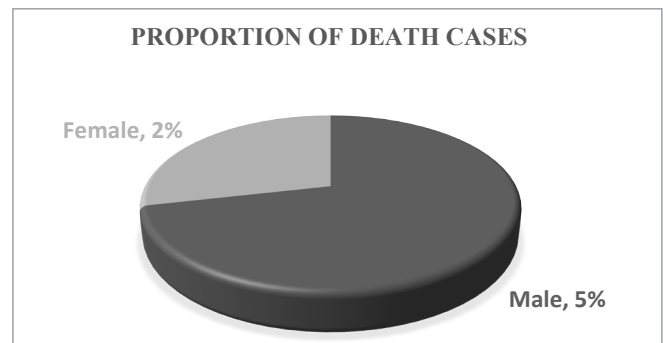
Discussion

This present study observed that the most frequent age group among critically ill COVID-19 positive patients was 54-68 years (47%), with a mean age of 59.83±13.07 years. The majority of these patients were male (70%). Another study found the mean age of critically ill COVID-19 positive patients to be 58.9±13.7 years, with 52.9% being male (n=319), which aligns with the findings of this study [16]. Most ICU patients came from urban areas (87%) and upper socio-economic backgrounds (85%). This may be due to the rapid spread of COVID-19 in densely populated urban areas and among wealthier individuals. We also found that the most

common comorbidities among ICU-admitted COVID-19 positive patients were diabetes mellitus (60%), hypertension (44%), ischemic heart disease (21%), bronchial asthma (13%), non-ST-elevation myocardial infarction (9%), chronic kidney disease (7%), chronic obstructive pulmonary disease (6%), benign enlargement of the prostate (5%), hypothyroidism (4%), hypokalemia (4%), benign prostatic hyperplasia (3%), cardiovascular disease (1%), and history of stenting (1%). A study conducted in Malaysia in 2021 reported that the most common comorbidities were hypertension (15.5%) and diabetes (11.0%), which are consistent with this study's findings [16]. In this study, the most prevalent symptoms among critically ill COVID-19 positive patients were shortness of breath (75%), fever (66%), cough (50%), acute respiratory distress (17%), lower respiratory tract infection (2%), and chest pain (2%). Another study conducted at Shaheed Suhrawardy Medical College Hospital, Dhaka, from July 2020 to December 2020, reported that most patients had a fever (95%), cough (88.4%), dyspnea (43.8%),. Additionally, 40% of patients reported digestive symptoms, including diarrhea (47.9%), vomiting (55.5%), loss of appetite (16.5%), abdominal pain (29.8%), abdominal bloating (24.8%), reflux (0%), and jaundice (3.3%), which are partially similar to our study [17]. We found that the mean c-reactive protein (CRP) level was 112.70 mg/L with a standard deviation of 76.85 mg/L, D-dimer was 3.16 ng/mL with a standard deviation of 0.09 ng/mL, procalcitonin (PCT) was 2.30 ng/mL with a standard deviation of 2.61 ng/mL, white blood cell (WBC) count was 21382 cells/μL with a standard deviation of 14880.12 cells/μL, lactate dehydrogenase (LDH) was 500.75 U/L with a standard deviation of 189.83 U/L, and ferritin was 1402.46 ng/mL with a standard deviation of 921.46 ng/mL. These observations are consistent with other studies [18-20]. In this study, 93% of critically ill COVID-19 positive patients survived, while 7% died. Among the deceased, older age and male gender were predominant. These deaths may be attributed to chronic kidney disease, cardiovascular disease, and multiple comorbidities. These findings are consistent with other studies [21-23]. The results of this study are expected to be valuable for clinicians, policymakers, and frontline workers in addressing and managing future waves of COVID-19 in Bangladesh.

Conclusion

This study found a low mortality rate (7%) and a high survival rate (93%) among critically ill COVID-19 positive patients in the ICU. It was observed that the majority of deaths occurred in older patients and males. Consequently, the national guidelines of Bangladesh, along with the World Health Organization (WHO) guidelines for the clinical management of critically ill COVID-19 patients, proved to be effective and standard for the management of the critically ill COVID-19 pos cases in Bangladesh.

Limitations of the Study

This was conducted at a single center with a limited purposive sample size and a short study duration. Therefore, the findings may not be representative of the entire country.

Recommendations of the Study

Future research could expand upon these findings by conducting a multicenter retrospective study with a large sample size and longitudinal data collection.

Conflict of Interest: None declared

References

1. World Health Organization Coronavirusdisease (COVID19): situationreport111.

2. Huang C, Wang Y, LiX, RenL, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet (London, England) 395 (2020): 497-506.

3. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirusinfected pneumonia in Wuhan, China. JAMA 323 (2020): 1061-9.

4. 4Anwar S, Nasrullah M, Hosen MJ. COVID-19 and Bangladesh: challenges and how to address them. Front Public Health 8 (2020): 154.

5. ISARIC (International Severe Acute Respiratory and emerging Infection Consorti Database) (2020).

6. Wu C, Chen X, Cai Y, Zhou X, Xu S, Huang H, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA internal medicine 180 (2020): 934-43.

7. Young BE, Ong SW, Kalimuddin S, Low JG, Tan SY, Loh J, et al. Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. Jama 323 (2020): 1488-94.

8. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, et al. Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy Region, Italy. Jama 323 (2020): 1574-81.

9. ICNARC report on COVID-19 in critical care ICNARC case mix programme database (2020).

10. ANZICS Australian and New Zealand Intensive Care Society. COVID-19 guidelines (2020).

11. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The lancet 395 (2020): 497-506.

12. Wan S, Xiang YI, Fang W, Zheng Y, Li B, Hu Y, et al. Clinical features and treatment of COVID-19 patients in northeast Chongqing. Journal of medical virology 92 (2020): 797-806.

13. Arentz M, Yim E, Klaff L, Lokhandwala S, Riedo FX, Chong M, et al. Characteristics and outcomes of 21 critically ill patients with COVID-19 in Washington State. Jama 323 (2020): 1612-4.

14. WHO. Clinical management of COVID 19 WHO (2020).

15. World Health Organization. Maintaining essential health services during the pandemic in Bangladesh: the role of primary health care supported by routine health information system. WHO South-East Asia Journal of Public Health 10 (2021): S1–S99.

16. Hasani WSR, Ganapathy SS, Lin CZ, Rifin HM, Bahari MN, Ghazali MH, et al. Comorbidities and clinical features related to severe outcomes among COVID-19 cases in Selangor, Malaysia. Western Pac Surveill Response J 12 (2021): 46-5.

17. Ghosh D, Ahmed A, Ahsan H, Ullah P, Nath M and Safwath S. Clinical Characteristics of COVID-19 Patients with Digestive Symptoms in a Tertiary Level Hospital. Open Journal of Gastroenterology 12 (2022): 232-248.

18. Amin MT, Hasan M, Bhuiya NM. Prevalence of Covid-19 associated symptoms, their onset and duration, and variations among different groups of patients in Bangladesh. Frontiers in public health 29 (2021): 738352.

19. Jin X, Lian JS, Hu JH, Gao J, Zheng L, Zhang YM, etal. Epidemiological,ClinicalandVirological Characteristics of 74 Cases of Coronavirus-Infected Disease 2019 (COVID-19) with Gastrointestinal Symptoms. Gut 69 (2020): 1002-1009.

20. Gupta N, Agrawal S, Ish P, Mishra S, Gaind R, Usha G, et al. Clinical and Epidemiologic Profile of the Initial COVID-19 Patients at a Tertiary Care Centre in India. Monaldi Archives for Chest Disease 90 (2020): 193-196.

21. Arentz M, Yim E, Klaff L, et al. Characteristics and Outcomes of 21 Critically Ill Patients With COVID-19 in Washington State. JAMA 323 (2020): 1612–1614.

22. Wang Y, Lu X, Li Y, Chen H, Chen T, Su N, et al. Clinical course and outcomes of 344 intensive care patients with COVID-19. American journal of respiratory and critical care medicine 201 (2020): 1430-4.

23. Anesi GL, Jablonski J, Harhay MO, Atkins JH, Bajaj J, Baston C, et al. Characteristics, outcomes, and trends of patients with COVID-19–related critical illness at a learning health system in the United States. Annals of internal medicine 174 (2021): 613-21.