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Original Article

Study of mortality risk factors and outcomes in COVID-19 patients at a tertiary care hospital in West Bengal, India

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Abstract:

Background: *The risk of mortality is high in Coronavirus disease-19 (COVID-19)patients. The management of COVID-19 patients may be aided by the identification of variables associated with mortality. The aim of the study was to ascertain the outcomes and mortality risk factors in COVID-19 patients at a tertiary care facility in West Bengal, India.*

Method: *A total of 94 patients with moderate to severe symptoms of COVID-19 were included in this observational descriptive study from April 2021 to June 2021. The patients with moderate to severe infection diagnosed by Indian Council of Medical Research (ICMR) guidelines admitted to the hospital, and those willing to participate in the study, were included. Those with mild symptoms and who refused to participate were excluded from the study. The severity of patient condition was determined by Ministry of Health & Family Welfare (MoHFW) guidelines. Informed consent has been obtained from patients. Data was analyzed by Microsoft® Excel workbook 2007 into SPSS v 21.0 (IBM, USA).*

Results: *Fifty-four percent of the patients had moderate, and 45.7% had severe infections. In-hospital mortality was 41.5% among moderate to severe infected COVID 19 positive patients. Non-survivors have significantly higher levels of neutrophils to lymphocyte ratio (NLR), blood urea, and sodium levels in comparison with survivors (P<0.05). On multivariate logistic regression, only the severity of infection (determined by Ministry of Health & Family Welfare guidelines) was an independent predictor of in-hospital mortality (adjusted OR, 3.73; 95% CI, 1.4717 to 9.4616; P=0.005).*

Conclusion: *COVID-19 patients with severe infection on admission are more likely to die.*

Keywords: *COVID-19, mortality, severity, NLR.*

Introduction

A new form of coronavirus called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was later identified as the cause of inexplicable pneumonia that first appeared in December 2019 in Wuhan, China (SARS-CoV-2).[1,2] The World Health Organization (WHO) later classified it as a pandemic on March 11, 2020. The official name of the condition is Coronavirus Disease-19 (COVID-19). SARS-CoV-2 is the infectious agent that gives rise to COVID-19.

Infected patients remain the main source of infection occurring through air droplets from sneezing and coughing. Aerosol transmission could not be ruled out in closed areas.[3]Mean incubation period of the disease has been reported to be between 5.2 days to 6.4 days.[4,5]

In COVID-19, fever, coughing, shortness of breath, muscle aches, etc., are among the typical symptoms.[6] While most patients experience no symptoms, the severity of symptomatic infection can range from moderate to catastrophic. While severe or critical symptoms may necessitate hospitalization, mild symptoms might not require treatment. Dyspnea and hypoxia are among the severe symptoms, whereas respiratory failure, shock, and/or multi-organ failure are among the critical symptoms.[7]

The Ministry of Health and Family Welfare (MoHFW) has classified the severity of COVID-19 as mild (upper respiratory tract symptoms and/or fever WITHOUT shortness of breath or hypoxia), moderate (respiratory rate 24/min and breathlessness, or SpO_2: 90% to 93% on room air), and severe (respiratory rate >30/min and breathlessness, or SpO_2 90% on

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room air).[8] One of the major risk factors for COVID-19 is age above 60, primarily because of a compromised immune system. The existence of comorbid conditions, including diabetes, hypertension, cardiovascular illnesses, lung diseases, cancer, etc., is one of the additional risk factors.[3]

The exact COVID-19 mortality rate is unknown because of a number of differences. The MoHFW website indicated a mortality rate of 1.19% as of August 17, 2022, with 527134 deaths.[9] COV bulletin of Govt. of West Bengal reported 21.423 deaths in the state.[10] According to COVID-19, age is one of the major risk factors for mortality.[11] The male gender is among other mortality risk factors[12], elevated levels of troponins, C-reactive protein, and lactate dehydrogenase (LDH) (CRP)[11], obesity, etc.[13] Presence of diabetes has been found to be an independent risk factor for mortality in COVID-19.[11] Age > 45 years, leukocytosis, elevated d-dimer, and elevated CRP were recently found as predictors of mortality in COVID-19 patients in an Indian study.[14] The aim of the study was to ascertain the outcomes and mortality risk factors in COVID-19 patients at a tertiary care facility in West Bengal, India.

Material and Methods:

During the second wave of the COVID-19 pandemic in India, this prospective observational descriptive study was carried out at the department of medicine at Murshidabad Medical College & Hospital in West Bengal (April 2021- June 2021). A study in the similar project area was conducted on Knowledge Attitude and Practice among hospital staffs during the first wave of COVID-19 pandemic. The overall knowledge score found to be "medium level" with 77% reporting correct answers and this knowledge was depended on marital status, educational background, age, occupation and place of residence.[15] In that project area, this study was conducted among 94 patients with SARS-CoV-2 who had moderate to severe symptoms. The study participants were hospitalized patients who had been diagnosed with moderate to severe SARS-CoV-2 according to ICMR standards and who were open to participating in the trial. Mildly symptomatic patients and individuals who declined to take part in the study were not included.

All the patients received Standard ICMR-approved treatment with available resources/ medicines. A convenient sampling procedure was conducted for this study. The severity of infection was determined using the Ministry of Health and Family Welfare (MoHFW) guidelines.[8]

The required information was collected from the patient's bed head ticket and laboratory reports. On admission, the required blood tests were conducted and followed up the patients till discharge.

If a patient was stable for 3 days without O_2 support, and the level of CRP and IL-6 were at normal levels, he/she was discharged.

Ethical Clearance:

Permission has been obtained from the competent authority for conducting this data collection. The informed written consent was obtained from the patients during admission procedure.

Data analysis:

For statistical analysis, the data were converted from Microsoft® Excel workbook 2007 into SPSS v 21.0 (IBM, USA). Frequency and percentage were used to express categorical data, and Chi-square tests with and without Yate's correction were used to compare them. The Student t-test was used to compare quantitative data that were expressed as mean and standard deviation (SD). The Mann-Whitney U test was used to compare non-normally distributed variables. They were expressed as median [Q1, Q3]. To calculate the odds ratio (OR), a single-variable regression analysis was employed Multivariate logistic regression analysis was used for the variables with a P value of less than 0.1. Statistical significance was defined as a P value of 0.05 or lower.

Table I: Baseline characteristics (N=94)

Variable	Frequency (n)	Percentage
Age (Years)		
<40	20	21
41-60	45	48
>60	29	31
Gender		
Male	48	51
Female	46	49
Religion		
Hindu	49	52
Muslim	45	48
Residence		
Rural	76	81
Urban	18	19
Co-morbidities		
Diabetes	19	20
Hypertension	18	19
Asthma	1	1
Pulmonary tuberculosis	0	0
Cancer	0	0
Covid Vaccinated		
Yes	12	13
No	82	87
Duration between first symptoms and hospitalization (days)		
0-3	24	26
4-7	53	56
8-14	13	14
≥15	4	4

Results

This study included 94 patients with SARS-CoV-2 who had moderate to severe symptoms of Covid infection.

Baseline characteristics

Table I presented the baseline characteristics of the study participants. The mean age of the patients was 54.78 years ranging from 28 years to 90 years. Male to female ratio was 1.04:1. Eighty-one percent participants were belonged to rural areas. Twenty percent had diabetes, 19% were hypertensive, and one patient had bronchial asthma. Only 12 patients had COVID-19 vaccination. Fifty-four percent had a moderate infection

Severity of infection

Table II shows general characteristics based on the severity of the infection. Fifty-four percent of the patients had moderate, and 45.7 % had severe infections. The patients were comparable in terms of age, gender, demography, presence of co-morbidities such as diabetes, hypertension, and asthma, previous vaccination, and duration of hospitalization after the onset of symptoms (days) between moderate and severe infections (P>0.05).

Table II: Comparison of general characteristics based on the severity of infection

	Moderate (n=51)	Severe (n=43)	P value
Age (Years)	53.92±13.92	55.81±14.26	0.518
Male gender	25 (49%)	23 (53.5%)	0.666
Demography			*0.505*
Rural	43 (84.3%)	33 (76.7%)	
Co-morbidities			
Diabetes	12 (23.5%)	7 (16.3%)	0.539
Hypertension	9 (17.6%)	9 (20.9%)	0.889
Pulmonary TB	0	0	-
Asthma	0	1 (2.3%)	0.932
Cancer	0	0	-
Previous vaccination	8 (15.7%)	4 (9.3%)	0.539
Duration of hospitalization after the onset of symptoms (days)	6.0 [4.0, 7.0]	5.0 [3.0, 7.0]	0.234

Data were expressed as n(%), mean±SD, and median [Q1, Q3]

Respiratory support

On admission

In this study, on admission, 73.4% were provided with a non-rebreather mask (NRBM), 18.1% were given a face mask, 4.3% nasal cannula, and 3.2% high flow (HF) as well as NRBM. Only one patient remained on room air.

During hospital stay

Only two patients required mechanical ventilation. Thirty-nine patients required only NRBM, 33 required HF as well NRBM, eight required bilevel positive airway pressure (BIPAP) along HF and NRBM, three required continuous positive airway pressure (CPAP) along HF and NRBM, four nasal cannulas, and five required only face mask.

In-hospital mortality

Table III shows a comparison of general characteristics based on in-hospital mortality. In our study, in-hospital mortality was 41.5%. Non-survivors were non-significantly elder in age compared to survivors (P=0.061). We observed that severe infection was significantly associated with in-hospital mortality (P=0.010).

Table III: Comparison of general characteristics based on in-hospital mortality

	Survivors (n=55)	Non-survivors (n=39)	P value
Age (Years)	52.50±12.70	58.00±15.32	0.061
Male gender	26 (47.3%)	22 (56.4%)	0.383
Demography			*0.583*
Rural	46 (83.6%)	30 (76.9%)	
Urban	09 (16.3%)	09 (23.1%)	
Co-morbidities			
Diabetes	10 (18.2%)	9 (23.1%)	0.748
Hypertension	12 (21.8%)	6 (15.4%)	0.607
Pulmonary TB	0	0	-
Asthma	1 (1.8%)	0	1.000
Cancer	0	0	-
Previous vaccination	7 (12.7%)	5 (12.8%)	1.000
Duration of hospitalization after the onset of symptoms (days)	5.0 [3.0, 7.0]	5.0 [3.0, 7.0]	0.643
Respiratory rate	23.27±2.25	24.20±3.17	0.099
SPO_2 (%)	92.80±9.48	90.97±7.71	0.324
Temperature (°F)	98.20±0.57	98.36±0.74	0.251
Severity of infection			0.010
Moderate	36 (65.5%)	15 (38.5%)	
Severe	19 (34.5%)	24 (61.5%)	

Data were expressed as n(%), mean±SD, and median [Q1, Q3]

Comparison of laboratory investigations based on in-hospital mortality

In this study, non-survivors have significantly higher levels of neutrophils to lymphocyte ratio (NLR) in comparison with survivors (P=0.031). Non-survivors have significantly higher

levels of urea in comparison with survivors (P=0.040). Similarly, sodium levels were significantly higher among non-survivors compared to non-survivors (P=0.008) (Table IV).

Table IV: Comparison of laboratory investigations based on in-hospital mortality

	Survivors (n=55)	Non-survivors (n=39)	P value
Temp. (F)	58.20±0.57	98.35±0.74	0.251
TLC	12488.90±4818.46	14087.17±6275.17	0.166
NLR	10.82±8.24	15.00±10.23	0.031
CRP	92.25±69.50	104.30±69.84	0.411
D-Dimer	2.1 [1.06, 6.48]	1.8 [0.7, 34]	0.744
Platelet Count	2.58±0.94	2.24±1.07	0.101
Urea	56.92±33.41	81.14±76.87	0.040
Cr	1.08±0.60	1.75±2.44	0.053
Na	136.81±6.02	140.20±5.88	0.008
K	3.96±0.63	4.14±0.65	0.180
RBS	234.92±156.73	215.97±108.00	0.516
Ferritin	613.36±482.14	918.10±540.33	0.134
LDH	913.45±447.67	1159.45±811.07	0.063
SGOT	41 [27, 71]	50 [35, 73]	0.256
SGPT	43 [32, 95]	49 [36, 76]	0.681

Independent predictors of in-hospital mortality

Upon univariate regression analysis, our study observed that the patients with moderate to severely infected patients had 3.032 higher odds of mortality in comparison to mildly infected patients (Table V).

Discussion

In order to find the parameters linked to mortality, 94 individuals hospitalized with moderate to severe COVID-19 infection were analyzed as part of this observational study. The in-hospital mortality rate in this study was 41.5%. Varying geographical regions are said to have different case fatality rates. In the USA, a survey of 5700 hospitalized COVID-19 patients revealed a 21% case fatality rate.[16] The case fatality rate in another Italian study was 29.7%.[17]

In Eastern India, Rai et al. found a 25.81% case fatality rate among 984 hospitalized COVID-19 patients.[18] According to Ansari et al., West Bengal was the state most severely affected by the first wave, with an average case fatality rate of 6.02%.[19] They used the official databases of the Government of India, state governments, and global databases meter to gather the data for their analysis.

The high case fatality rate in our study could be for a variety of causes. One of the explanations could be that it was a tertiary care referral facility, where most of the patients were sick and brought in from distant locations. It has been discovered that receiving a COVID-19 immunization is crucial for COVID-19 patients' survival. According to Muthukrishnan et al., fully immunized individuals had a 12.5% mortality rate, while unvaccinated patients had a 31.45% mortality rate.[20] They observed that among COVID-19 patients, having received all recommended vaccinations was an independent predictor of survival. Up to 80% less hospitalization has been seen in tests on the effectiveness of the Astra Zeneca (ChAdOx1 nCoV-19).[21] Only 12.2% of patients in our research had received all recommended vaccinations, and vaccination status did not significantly predict survival. It has been demonstrated that COVID-19 vaccinations can reduce infections by 80–94%.[22,23]

Table V: Univariate logistic regression analysis for calculation of odds ratio

	Non-survivors (n=39)	Odds ratio	95% CI (Lower-Upper)	P value
Age (Years)				0.181
>60 (n=29)	15	1.830	0.7550 to 4.4375	
≤60 (n=65)	24	1.000	[Ref]	
Gender				0.383
Male (n=48)	22	1.443	0.6325 to 3.2941	
Female (n=46)	17		[Ref]	
Residence				
Urban (n=18)	9	1.533	0.5463 to 4.3040	0.417
Rural (n=76)	30		[Ref]	
Diabetes				0.561
Yes (n=19)	9	1.350	0.4906 to 3.7145	
No (n=75)	30		[Ref]	
Hypertension				0.437
Yes (n=18)	6	0.651	0.2213 to 1.9183	
No (n=76)	33		[Ref]	
Previous vaccination				0.989
Yes (n=82)	34	0.992	0.2902 to 3.3889	
No (n=12)	5		[Ref]	
Severity of infection				
Severe (n=43)	24	3.032	1.2938 to 7.1036	0.010
Moderate- (n=51)	15		[Ref]	

On multivariate logistic regression, only the severity of infection was an independent predictor of in-hospital mortality (adjusted OR, 3.73; 95% CI, 1.4717 to 9.4616; P=0.005).

In our study, non-survivors NLR levels were considerably greater than those of survivors (P=0.031). NLR is a biomarker that reflects neutrophil activation and systemic inflammation.

NLR was identified by Liu et al. as an independent risk factor for in-hospital mortality in COVID-19 patients in a previous study.[24]According to a meta-analysis, elevated NLR levels upon admission were linked to COVID-19 mortality.[25]

Non-survivors in this study had significantly higher blood urea levels at admission compared to survivors (P=0.040). Hachim et al. reported that urea levels (>6.5 mmol/L) might predict ICU admission among COVID-19 patients.[26] According to a study conducted among the Turkish population, non-survivors median BUN levels were substantially greater than those of the survivor group (p 0.001) than survivors.[27]

According to reports, hypernatremia is linked to higher mortality rates in hospitalized patients.[28] An examination of the COVID-19 registry showed that hypernatremia was linked to mortality in COVID-19 patients.[29] When compared to survivors, non-survivors had considerably higher blood sodium levels (P=0.008).

According to our investigation, the severity of the COVID-19 infection was a reliable predictor of patient mortality. Mortality was reported to be 1.1% in non-severe patients and 32.5% in severe patients, according to Li et al.[30] According to a study from India, mortality among COVID-19 patients was substantially correlated with the severity of the condition.[31]

In a multicentric trial, patients without respiratory failure had a 1% chance of dying after 15 days of hospitalization, but those with moderate to severe respiratory failure had a survival rate of only 56%.[32]

The major limitations of this study are small sample size, sampling procedure and single data collection center. The results may not be as generalizable as they could be because this was a single-center study with a limited sample size.

Conclusion

Among COVID-19 hospitalized patients, the total in-hospital death rate was 45.1%. On admission, non-survivors' NLR, urea, and serum sodium levels were noticeably greater than those of survivors. Mortality was unrelated to age, gender, the presence of co-morbidities, or immunization status. However, additional research with sizable sample size is required to confirm our findings.

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Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article.

Disclosure statement

No potential conflict of interest was reported by the authors.

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