ORIGINAL ARTICLE

Clinical and Laboratory Profile of COVID-19 Patients Presenting to a Tertiary Care Hospital in Jaipur, Rajasthan: An Observational Study

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Abstract

Background: In this study, we aim to report the clinical and laboratory profile of 187 coronavirus disease 2019 (COVID-19) patients admitted to a tertiary care hospital in Jaipur, Rajasthan, India.

Materials and methods: Case records were accessed retrospectively, and demographic profile, clinical presentation, and two laboratory markers [neutrophil:lymphocyte ratio (NLR) and C-reactive protein (CRP)] were evaluated in 187 patients with confirmed COVID-19 infection. Patients were divided into two groups for analysis—recovered/discharged group and mortality group.

Results: In our study, the mortality rate was 11.8% (22 out of 187 cases) with similar age and sex distribution between the two groups. A higher proportion of patients in the mortality group had severe disease as compared to the recovered group (72.7 vs 8.5%). Patients who died had a longer mean duration of symptoms before admission (5.2 vs 3.3 days), with a lower duration of hospital admission (5.6 vs 10.6 days) as compared to the recovered group. Fourteen out of 22 patients in the mortality group required non-invasive or invasive ventilatory support at admission, compared to 21 out of 165 patients who recovered; and 86.4% of patients who died had comorbidities vs 43.6% of those who recovered. The mean NLR was over 3.5 times higher and mean CRP at admission nearly 2.6 times higher in the mortality group.

Keywords: C-reactive protein, Coronavirus disease 2019, Neutrophil:lymphocyte ratio.

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Introduction

Derived from the Latin term *corona* meaning crown, due to their characteristic appearance on electron microscopy, coronaviruses are a group of RNA viruses that are important animal and human pathogens.[1] Cross-species transmission of some of these viruses led to the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002 to 2003[2] and the Middle East Respiratory Syndrome (MERS) outbreak in 2012.[3]

A cluster of severe pneumonia cases in Wuhan, China, in December 2019, led to the identification of a novel coronavirus which was more infectious than the SARS and MERS coronavirus; and the disease was designated coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO)[4] and the virus was named SARS-Coronavirus 2 (SARS-CoV-2). The virus spread rapidly due to human-to-human transmission and was characterized as a pandemic by the WHO on March 11, 2020,[5] the first coronavirus to cause a pandemic.[5] The WHO weekly epidemiological update dated September 21, 2020, reported over 30.6 million cases and over 950,000 deaths worldwide; with Indian total cases and deaths reported at 5,400,619 and 86,752, respectively.[6]

Currently, India has the second-highest number of cases worldwide, being second only to the United States, but the case fatality rate is among the lowest in the world at approximately 1.6%,[6] however, the low number of reported deaths might be due to shortcomings in vital registration, testing, and classification of COVID-19 deaths.[7] Since only a fraction of cases are diagnosed and reported, the reported numbers of cases underestimate the overall burden of COVID-19.

Being a novel coronavirus infection, understanding the disease is ever-changing and ever-evolving. The host receptor for the entry of the virus into the cell is the angiotensin-converting enzyme 2 (ACE2), with the cellular serine protease TMPRSS2 priming the S-protein which is essential for pathogenesis in the infected host and viral spread; inhibition of this pathway may provide a future avenue for therapy.[8] While the understanding of transmission risk is incomplete, the main mode of transmission is person-to-person; through close-range contact, droplet infection, and contaminated surfaces.

The spectrum of the disease ranges from asymptomatic to severe life-threatening disease. Mild disease with no pneumonia is the most common presentation noted in 81%, with a severe or critical disease in the remaining 19%.[9] Advanced age and the presence of comorbidities such as cardiovascular disease, diabetes

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mellitus, hypertension, chronic lung disease, chronic kidney disease, cancer, and obesity are among the major risk factors for severe disease.

In this study, we characterize the clinical and laboratory profile of COVID-19 patients presenting to a tertiary care hospital in Jaipur, Rajasthan, India. We describe the outcomes of the first 187 patients admitted to our facility and explore the risk factors that might be associated with in-hospital mortality.

Aims and Objectives

- To observe the case recovery rate and mortality rate at our center.
- To observe the differences in clinical profile between the two groups.
- To compare the two laboratory parameters [NLR and C-reactive protein (CRP)] between the two groups.

Materials and Methods

This is a single-center study conducted at Mahatma Gandhi Hospital, Jaipur, Rajasthan, India, a tertiary care center.

Inclusion Criteria

- Test positive for COVID-19 by RT-PCR.
- Informed consent.

Exclusion Criteria

None.

Data Collection and Analysis

We accessed the physical case records retrospectively and relevant information (demographics, clinical picture, laboratory investigations) were entered on a study proforma, which was later entered into Excel. The disease severity in symptomatic patients was classified as follows:

- Mild disease—symptomatic patients with no evidence of viral pneumonia or hypoxia (respiratory rate <24/minute, SpO_2 >94% on room air).
- Moderate disease—clinical signs of pneumonia (fever, cough, dyspnea, fast breathing); maintaining SpO_2 90 to 94% on room air and respiratory rate 24 to 30/minute.
- Severe disease—signs of severe pneumonia (respiratory rate >30/minute, SpO_2 <90% on room air).

Normally distributed variables are expressed as means ± standard deviations and categorical variables as frequencies and percentages. The *t*-test was conducted to compare continuous variables and the χ^2-test was used to analyze categorical variables. A p value < 0.05 was considered statistically significant.

Results

A total of 187 patients were included in the analysis, admitted at Mahatma Gandhi Hospital from the period of April 2020 to June 2020.

Of these 165 (88.2%) patients recovered and 22 patients (11.8%) died (Table 1).

There was a statistically significant difference in the severity of disease at admission between the two groups; higher severity of the disease in the mortality group as compared to the recovered group (p value 0.000). Among the recovered patients, 134 (81.2%) had asymptomatic or mild disease, 17 (10.3%) had moderate disease, and 14 (8.5%) had severe disease; while in patients who died, 3 (13.6%) had mild disease, 3 (13.6%) had moderate disease, and 16 (72.7%) had severe disease (Table 2).

Table 1: Outcome of admitted patients

Outcome	*Number of patients*	*Percentage*
Recovered	165	88.2
Mortality	22	11.8
Total	187	100

Table 2: Disease severity at admission

Disease severity	*Recovered number (%)*	*Mortality number (%)*	*p value*
Asymptomatic/ mild	134 (81.2)	3 (13.6)	0.000
Moderate	17 (10.3)	3 (13.6)	
Severe	14 (8.5)	16 (72.7)	
Total	165	22	

Table 3: Mean age

Outcome	*Number (%)*	*Mean age (years)*	*±SD (years)*	*p value*
Recovered	165 (88.2)	52.647	17.62	0.086
Mortality	22 (11.8)	59.409	14.15	

Table 4: Sex distribution

Sex	*Recovered number (%)*	*Mortality number (%)*	*p value*
Male	111 (67.3)	19 (86.4)	0.068
Female	54 (32.7)	3 (13.6)	
Total	165	22	

There was a statistically non-significant difference in the mean age and sex between the two groups. The mean age for the recovered patients was 52.6 years; and 59.4 years in the mortality group (p value 0.086, Table 3). One hundred and eleven (67.3%) of the recovered patients were male and 54 (32.7%) were female; compared to 19 (86.4%) and 3 (13.6%) male and female patients, respectively, in the mortality group (p value 0.068, Table 4).

The mean duration of symptoms before admission was 3.3 days in the recovered group and 5.2 days in the mortality group; whereas the mean duration of hospital stay for recovered patients was 10.6 days, compared to 5.6 days in the mortality group. Both the results were highly significant with a p value of 0.004 and 0.000, respectively (Table 5). Thirty-nine (23.6%) patients in the recovered group gave a history of contact with a known COVID-19 positive patient, and one (4.5%) patient in the mortality group had a history of contact (p value 0.04, statistically significant) (Table 6).

In the recovered group, 144 (87.3%) patients did not require ventilatory support at admission, while 20 (12.1%) patients required non-invasive ventilation and 1 (0.6%) patient required invasive ventilation at admission. For the mortality group, a higher percentage of patients required non-invasive or invasive ventilation at admission [8 (36.3%) each required no ventilator support and non-invasive ventilation, and 6 (27.2%) required

Table 5: Mean duration of symptoms before admission and duration of hospital admission

Duration	*Outcome*	*Number (%)*	*Mean (days)*	*±SD (days)*	*p value*
Duration of symptoms before admission	Recovered	165 (88.2)	3.303	2.889	0.004
	Mortality	22 (11.8)	5.227	3.161	
Duration of hospital admission	Recovered	165 (88.2)	10.642	5.132	0.000
	Mortality	22 (11.8)	5.59	4.031	

Table 6: History of contact

History of contact	*Recovered number (%)*	*Mortality number (%)*	*p value*
Yes	39 (23.6)	1 (4.5)	0.040
No	126 (76.4)	21 (95.4)	
Total	165	22	

Table 7: Requirement of ventilatory support at admission

Ventilatory support at admission	*Recovered number (%)*	*Mortality number (%)*	*p value*
No support	144 (87.3)	8 (36.36)	0.000
Non-invasive ventilation	20 (12.1)	8 (36.36)	
Invasive ventilation	1 (0.6)	6 (27.3)	
Total	165	22	

Table 8: Presence of comorbidities

Comorbidities	*Recovered number (%)*	*Mortality number (%)*	*p value*
Yes	72 (43.6)	19 (86.4)	0.000
No	93 (56.4)	3 (13.6)	
Total	165	22	

Table 9: Distribution of comorbidities

Comorbidities	*Recovered number (%)*	*Mortality number (%)*
Diabetes mellitus	37 (22.4)	13 (59.1)
Hypertension	40 (24.2)	9 (40.9)
Coronary artery disease	7 (4.2)	3 (13.6)
Hypothyroidism	13 (7.9)	0 (0)
Lung disease	6 (3.6)	1 (4.5)
Chronic kidney disease	6 (3.6)	1 (4.5)
Cerebrovascular accident	2 (1.2)	2 (9.1)
Malignancy	2 (1.2)	1 (4.5)
Miscellaneous	7 (4.2)	0 (0)
No comorbidity	93 (56.4)	3 (13.6)
Total	165	22

Table 10: Neutrophil:lymphocyte ratio (NLR)

Neutrophil:lymphocyte ratio	*Number (%)*	*Mean NLR*	*±SD*	*p value*
Recovered	159 (85.02)	3.802	4.025	0.000
Mortality	19 (10.16)	13.843	9.591	

Table 11: Elevation of C-reactive protein at admission

C-reactive protein at admission (mg/L)	*Recovered number (%)*	*Mortality number (%)*	*p value*
<5 or no data	87 (52.7)	6 (27.3)	0.025
>5	78 (47.3)	16 (72.7)	
Total	165	22	

Table 12: Value of C-reactive protein at admission among those with an elevated value

C-reactive protein at admission (mg/L)	*Number*	*Mean (mg/L)*	*±SD (mg/L)*	*p value*
Recovered	78	65.7	75.481	0.000
Mortality	16	170.5	117.486	

invasive ventilation]. The difference between the recovered group and mortality group was highly significant (*p* value 0.000, Table 7).

Seventy-two (43.6%) patients in the recovered group had comorbidities and 19 (86.4%) had comorbidities in the mortality group (*p* value 0.000, Table 8). The most common comorbidity in the recovered group was hypertension (40 out of 72 patients) and diabetes mellitus in the mortality group (13 out of 22 patients). Table 9 shows the distribution of comorbidities between the two groups.

The mean neutrophil:lymphocyte ratio (NLR) was 3.8 and 13.8 in the recovered and mortality groups, respectively, a highly significant difference (*p* value 0.000, Table 10) [Note—159 patients in the recovered group and 19 patients in the mortality group had documented blood count data].

Seventy-eight (47.3%) patients in the recovered group had a documented elevated CRP at admission, compared to 16 (72.7%) in the mortality group; a significantly higher percentage in the mortality group (*p* value 0.025, Table 11) [Note—47 patients in recovered group and 6 patients in the mortality group had no CRP documented]. Among those with an elevated CRP, the mean elevation of CRP was also significantly higher in the mortality group vs the recovered group (170.5 vs 65.7 respectively, *p* value 0.000, Table 12).

Discussion

The mortality rate at our hospital, a tertiary care center, out of 187 in-patients of COVID-19 was 11.8% and the recovery rate was 88.2%. This is in-line with the reported fatality rate in hospitalized adult patients at 4 to 11%.[10] A meta-analysis and systematic review reported the case fatality rate in hospitalized patients at 13.9%.[11] The severity of disease at admission was higher in the mortality group as compared to the recovered group.

The difference in mean age and sex was statistically non-significant between the two groups in our study. The mean age for the recovered and mortality group was 52.6 and 59.4 years, respectively. Other studies have reported a mean age of 51.97 years.[11] Male sex preponderance has also been reported at 55.9% of the cases in a meta-analysis of patients across 18 studies.[11]

The higher mean duration of symptoms before admission in the mortality group indicates that patients who die tend to

present later in the course of their illness, and many of them enter an irreversible cycle of disease progression at that point leading to death. This is also correlated with the finding that patients who die have a shorter hospital stay as compared to patients who recover. Singhal[10] reported the median time to hospitalization at 7 days and onset of acute respiratory distress syndrome at 8 days. Our results are in contrast to the study from Richardson et al.[12] who reported a median length of stay at 3.9 days for discharged alive patients and 4.8 days for those who died.

Only 40 out of 185 patients had a history of contact with known COVID-19 positive patients or travel to an international region with known COVID-19 transmission. This is in contrast to the nearly 90% of patients having an exposure history as reported by Yang et al.[13] This indicates the nature of the decentralized spread of the disease in our region and multiple clusters of cases leading to spread, rather than a single easily identifiable source.

Twelve percent of patients required non-invasive ventilatory support at admission in the recovered group, compared to a significantly higher 36.36% in the mortality group (overall 14.97%). The percentage of patients requiring invasive ventilation at admission was 0.6 and 27.3% for the two groups, respectively (overall 3.74%). Richardson et al.[12] noted that 320 out of 2,634 patients (12.2%) with a known outcome required invasive ventilation. 1.8% of the discharged alive patients in their study recovered invasive ventilation; while almost 51% of the patients who died, required invasive ventilation.[12] 88.1% of patients who required mechanical ventilation died in their study,[12] compared to 85.7% (6 out of 7 patients) in our study. The impact of COVID-19 on the Indian population appears to be much lower than in other countries, with reports stating 4.16% of the patients required mechanical ventilation and 15.9% required oxygen supplementation.[14] The requirement of any type of ventilator support at admission can be considered as a poor prognostic factor, as this would correlate with the severity of the disease on admission.

The presence of comorbidities was also significantly higher in the mortality group in our study. Up to 93.9% of hospitalized patients have been reported to have comorbidities.[12] Meta-analysis by Rodriguez-Morales et al.[11] concluded 36.8% of cases have comorbidities, the most common being hypertension and second most common was cardiovascular disease. Our study had diabetes mellitus as the most common, and hypertension as the second most common comorbidity overall. Du et al.[15] found a statically significant higher percentage of patients with hypertension died, while the difference for those with diabetes was not significant. This is in contrast to our study, where diabetes mellitus was the most common comorbidity in patients who died. A study of 85 fatal COVID-19 cases by Du et al.[16] also had hypertension as the most common comorbidity (37.6%) in fatal cases, and diabetes mellitus was second (22.4%). This might indicate the importance of diabetes mellitus as the prognostically most important comorbidity in the Indian population.

Yang et al.[17] also had a significantly higher NLR in patients with severe disease as compared to those with a non-severe disease (20.7 vs 4.8) and their results also showed that NLR was positively correlated with the risk of COVID-19. Neutrophil:lymphocyte ratio was considered an independent prognostic biomarker affecting pneumonia progression in COVID-19 and its integration into prognostic nomograms could lead to improved prediction.

Wang[18] studied CRP levels in an early stage of COVID-19 and concluded that CRP levels correlated positively with severe presentation and diameter of lung lesions (critical > severe > moderate > mild). Moreover, CRP is associated with disease development and is an early predictor of severe COVID-19.[19] While CRP levels were statistically significantly higher in the deceased group as compared to survivors in the study by Du et al.,[15] presumably due to the presence of secondary bacterial infection; but this difference was nullified upon univariate analysis. Our study indicates that a higher CRP at admission was associated with higher mortality, and the degree of elevation in those who die is almost 2.6 times that of survivors.

Conclusion

Out of 187 cases of COVID-19 at our hospital, the following results are highlighted:

- The case fatality rate was 11.8% at our center.
- The majority of recovered cases had the asymptomatic or mild disease at admission.
- The presence of moderate or severe disease at admission was associated with higher mortality.
- Fatal cases present long after the onset of symptoms and die early in the course of their admission, as compared to those who recover.
- The majority of patients requiring invasive ventilation at admission do not survive.
- Comorbidities, particularly diabetes mellitus is associated with a higher mortality rate.
- High NLR and elevation of CRP at admission associated with a higher mortality.
- The degree of elevation of CRP was almost 2.6 times in the mortality group as compared to those who recover.

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