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Clinical characteristics, treatment outcomes and factors associated with severe illness in 813 COVID-19 patients admitted in a tertiary care hospital of eastern India

ABSTRACT

Introduction: This retrospective observational study has been designed to identify clinical characteristics, treatment outcomes and factors associated with severe illness in 813 COVID-19 patients hospitalised in an Indian tertiary care hospital.

Material and methods: This was a retrospective analysis of patient admitted between 1st July to 15th Aug 2020 with COVID-19 infections. Logistic regression was performed to explore the association of clinical characteristics and laboratory parameters with the risk of severe disease and mortality. The statistical significance level was set at 0.05 (two-tailed).

Results: Out of 813 study patients, 630 (77.50%) patients were categorised with mild to moderate while 183 (22.50%) patients as severe Covid infection. Mortality was significantly higher in severe Covid patients as compared to mild moderate cases (66.21% *vs.* 10.31%. $p<0.0001$. Patients with severe infection were significantly more likely to have diabetes hypertension, chronic kidney disease (CKD) and had significantly higher Neutrophil count, serum creatinine, C-reactive protein (CRP), ferritin, D-Dimer and decreased haemoglobin, lymphocyte and serum calcium than patients with mild-moderate infection. In Multivariate analysis, age more than 60 years [AOR: 2.114, 95% CI (1.05–4.254), 0.036], NLR more than 3.3 [AOR: 1.082, 95% CI (1.030–1.137), 0.002] and D-Dimer >1 μg/mL [AOR: 2.999 (1.464- 6.146),0.003] were found significantly associated with severe disease ($p < 0.05$). Factors associated with mortality were age more than 60 years, presence of breathlessness, severe disease or presence of chronic kidney disease.

Conclusions: Factors like elderly age (age > 60 years), elevated NRL, CRP, D-Dimer and serum ferritin were associated with significantly higher risk to develop severe COVID-19 infections. Elderly, and patients with CKD were associated with worse outcome.

Key words: COVID-19, severity markers, mortality predictors, intensive care

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Introduction

COVID-19, is a viral pneumonia of unknown origin first identified in Wuhan China and caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1, 2]. This illness has claimed well over 2.7 million lives till date [3]. In India, there are many factors, including socio cultural practices which play an important role in determining the morbidity and mortality of patients with COVID-19. Poverty, lack of good healthcare infrastructure and even the female gender predispose many patients to delayed treatment and thus a possibly worse prognosis. Determining clinical factors associated with a severe infection or identifying those factors which predict progression to a severe disease, thus assumes great importance. Though we are aware about several risk factors implicated in severe infection, like age, sex and ethnicity, co-morbidities and some laboratory indicators [4–7] there are only very limited data specific to the Indian population which can characterise severe COVID-19 infection and treatment outcomes from India [8, 9].

This retrospective observational study has been designed to identify clinical characteristics and treatment outcomes in 813 Covid patients hospitalised for treatment of COVID-19 infection in an Indian tertiary care hospital.

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Objectives of study

1. Comparison of clinical characteristics in severe Covid cases versus those with mild-moderate infections.
2. Comparison of treatment outcomes in Covid patients presenting with varying degrees of severity.
3. Factors associated severe disease in COVID-19 infections.

Material and methods

This was a retrospective hospital record based observational study, conducted between 1st July, 2020 to 15th August 2020. Institutional Human Ethics Committee of AIIMS Patna reviewed and approved study protocol with approval letter number (AIIMS/Pat/IEC/220/552). We included all adult patients aged more than 18 years of age with RTPCR or Antigen positive COVID-19 infections admitted during the given period. A COVID-19 positive report from a government recognised testing facility was mandatory for inclusion.

All patients admitted to our institute are investigated and treated as per the Covid treatment protocol of our institute. A baseline battery of investigations is performed and based upon clinical characteristics and severity; patients are triaged. If fulfilling the admission criteria, sick patients are shifted to our intensive care units else they are shifted to various treatment wards. During the study period the number of admissions overwhelmed our intensive care infrastructure. Some sick patients were thus treated even in the wards.

We retrieved data of all patients from the medical records department and it included demographic information, exposure history, clinical symptoms, comorbidities, and laboratory test results, details of treatment provided, length of hospitalization, complications and outcome. All the data were collected by residents and two faculty from different department reviewed and cross-checked for validation. Severity of COVID-19 infection has been classified according to Ministry of health & family welfare, Government of India's guidelines [10].

Following laboratory data parameters were collected at time of admission: complete blood count parameters (CBC), urea, creatinine, total protein, albumin, AST, ALT, Lactate dehydrogenase (LDH), Ferritin, C-reactive protein (CRP), Calcium, prothrombin time (PT), activated partial thromboplastin time (APTT), international normalized ratio (INR), & D-dimer.

Definitions of mild, moderate and severe COVID-19 [10]

Mild: No evidence of breathlessness or hypoxia (normal saturation)

Moderate: Breathlessness and/or hypoxia (saturation 90–94% on room air), respiratory rate of 24 or more and no features of severe disease

Severe: Any of the following–Severe respiratory distress, oxygen saturation < 90% on room air, respiratory rate > 30, shock or evidence of a life-threatening organ dysfunction

Statistical analysis

Continuous data have been presented as mean ± SD and categorical variables in relative frequencies, and percentages. All statistical analyses have been performed using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Shapiro-Wilk test was used to assess the normality of continuous variables. Significant p-value of this test was considered as absence of normality, hence, non-parametric test such as Mann-Whitney Wilcoxon Rank test was used to compare the equality of distribution of continuous variables, which were presented as median with inter-quartile range, otherwise, presented as mean with 95% confidence intervals. Categorical variables were presented as proportion with 95% confidence intervals. Chi-square test was performed to test the independence of attributes. Fisher's Exact test was used whenever cell frequencies were less than 5. Univariate and multivariate logistic regression was performed to explore the association of clinical characteristics and laboratory parameters with the risk of severe disease. We included clinical and lab variable in the multivariate logistic regressions, based on clinical justification and statistical reasoning from univariate analyses. Variables from univariate analyses with $p < 0.05$ were recruited for the multivariate logistic regressions model. The statistical significance level was set at 0.05 (two-tailed).

Results

The study included reverse transcriptase polymerase chain reaction (RTPCR) or antigen positive, 813 hospitalized patients with COVID-19 infection. Compatibility test showed data is normally distributed, hence parametric test were used to compare severe and non-severe group. Comparing the demography and clinical characteristics of patients, 639 (78.59%) were males, the rest, 21.41% were females. The mean age of study patients was 50.96 ± 15.3 years. Pa-

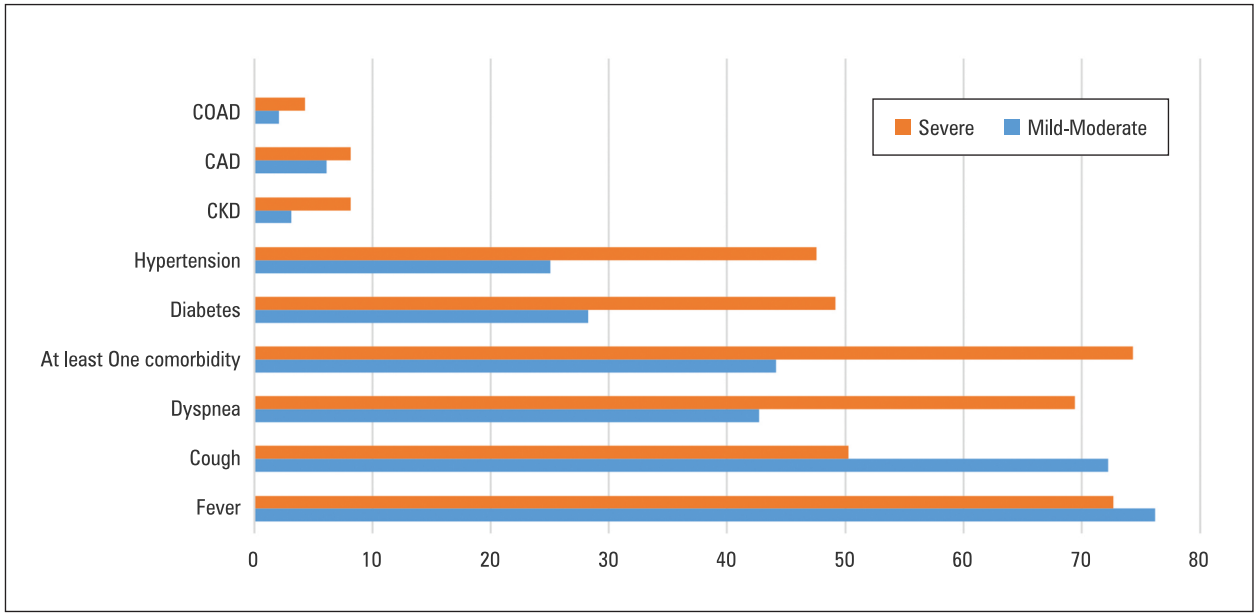


Figure 1. Summarising clinical symptoms and comorbidities among study patients (n = 813) [number on X axis represent proportion (%)]

tients aged 41 to 60 years were most commonly affected (45.87%). At time of admission, 630 (77.50%) patients were categorised with mild to moderate infection while 183 (22.50%) patients were diagnosed with severe Covid infection.

Clinically, a significantly higher proportion of young patients in the age group of 21–40 years had mild-moderate infection compared to severe disease (30.31% *vs.* 7–10%, $p < 0.05$). Proportion of patients older than 60 years with severe disease was significantly higher compared to those with only mild-moderate infection (48.63% *vs.* 23.01%, $p < 0.0001$).

The most common symptoms on admission were fever (75.39%), cough (67.28%) and dyspnoea (42.69%). History of well-defined contact with Covid positive patients was found only in 72 (8.75%) patients. Four hundred fourteen patients (50.92%) had at least one pre-existing comorbidity. Diabetes, hypertension, coronary artery disease (CAD) and chronic kidney disease (CKD) were the most common comorbidities found in 32.96%, 30.13%, 6.15% and 4.42% of patients respectively. Comparing the presence of comorbidities in severe versus mild-moderate disease revealed diabetes in 49.18% of severe cases *vs.* 28.25% in mild-moderate cases. Similarly, hypertension 47.54% *vs.* 25.07% and CKD in 8.19% *vs.* 3.13%. Thus diabetes, hypertension and CKD were found to be in significantly higher proportions of people with severe disease (Figure 1). As can be expected, mortality was significantly higher in severe covid patients as compared to mild moderate cases. (66.21% *vs.* 10.31%, $p < 0.0001$).

Routine blood parameters comparisons revealed that all patients with severe covid infection showed higher white-blood cell counts, neutrophil counts, blood urea, serum creatinine, AST, LDH, CRP, PT, ferritin, and D-dimer levels. On the contrary, lower absolute lymphocyte counts, serum calcium, blood haemoglobin and total protein levels ($p < 0.001$) were noted in patients with severe disease. The demographic and lab characteristics of the patients are shown in Table 1.

Assessing the treatment outcomes, out of total 813 patients, 234 (28.75%) patients required intensive care. 85 of 813 (10.45%) patients required Non-invasive ventilation (NIV) support while 65 (7.99%) required mechanical ventilation. Among the 183 patients who presented with severe disease, 43 (23.49%) patients required NIV support while 39 (21.31%) required mechanical ventilation. 126 of these patients succumbed to their illness, compared to 65 out of 630 patients who presented with mild-moderate illness. Of these 630 patients classified with mild-moderate disease, 521 (82.69%) were treated in general wards and 109 (17.30 %) required Intensive Care Unit (ICU) support. 58 of 183 (31.69) of severe Covid patient received initial treatment in general wards while 125 (66.83%) patients were admitted in ICU (Figure 2).

With respect to management strategies, tablet hydroxychloroquine, azithromycin was given in

Table 1. Comparison of demographic and lab variable between severe to non severe COVID-19 patients

Characteristics	Total (n = 813)	Mild-Moderate (n = 630)	Severe (n =183)	P value
Age	50.96 ± 15.3	48.45 ± 15.10	59.84 ± 12.80	< 0.0001
< 20	02 (0.2)	02 (0.3)	0 (0)	
20–40	204 (25.09)	191 (30.31)	13 (7.10)	
41–60	373 (45.87)	292 (46.34)	81 (44.26)	
> 60	234 (28.29)	145 (23.01)	89 (48.63)	< 0.0001
Gender M	639 (78.59)	486 (79.28)	153 (83.61)	0.0601
F	174 (21.40)	144 (22.85)	30 (16.39)	
History of contact	72 (8.85)	67 (8.24)	05 (2.73)	0.0009
At least one comorbidity	414 (50.92)	278 (44.12)	136 (74.31)	< 0.0001
Mortality	186 (22.87)	65 (10.31)	121 (66.21)	< 0.0001
Lab variable				
Haemoglobin (g/dL)	11.83 ± 3.42	11.87 ± 1.96	11.26 ± 2.20	< 0.003
Total leukocyte count (count/μL)	10.0 ± 8.12	8.77 ± 7.39	14.32 ± 9.09	0.0002
Platelet count (count/μL)	201.56 ± 99.94	199.83± 96.83	207.50 ± 110.04	0.340
Neutrophil (%)	76.33 ± 15.23	73.19± 14.29	87.16 ± 13.31	0.0001
Lymphocyte (%)	18.84 ± 13.19	21.80 ± 12.83	8.65 ± 8.48	0.0001
Eosinophil (%)	0.94 ± 1.8	1.13 ± 1.99	0.27± 0.88	0.0001
SGPT (U/L)	80.32 ± 86.99	77.60 ± 75.14	89.65 ± 118.74	0.100
SGOT (U/L)	75.36 ± 172.23	66.35 ± 64.90	106.26 ± 340.98	0.005
STP (g/dL)	7.11 ± 2.54	7.30 ± 2.80	6.48 ± 1.07	0.001
Serum albumin (g/dL)	3.67 ± 0.55	3.80 ± 0.47	3.21 ± 0.56	1.0
Serum globulin (g/dL)	3.55 ± 0.54	3.38 ± 0.52	3.25 ± 0.60	1.00
Blood urea (mg/dL)	47.27 ± 50.42	38.04 ± 37.99	78.93 ± 71.01	0.0001
Creatinine (mg/dL)	1.16 ± 1.53	1.01 ± 1.25	1.65 ± 2.19	0.0001
Serum calcium	8.75 ± 0.82	8.89 ± 0.71	8.28 ± 0.99	0.001
CRP (ng/mL)	94.83 ± 99.47	65.12 ± 76.83 (n = 304)	171.62 ± 138.29 (n = 118)	0.0001
Ferritin (ng/mL)	562.90 ± 563.47	467.32 ± 482.85 (n = 438)	915.22 ± 744.52 (n = 118)	0.0001
D-Dimer (mcg /mL)	2.39 ± 6.55	1.35 ± 2.10 (n = 426)	5.95 ± 12.98 (n = 124)	0.0001
LDH (U/L)	903.68 ± 557.95	730.61 ± 407.48 (n = 233)	1335.41 ± 827.21 (n = 94)	< 0.0001
PT	13.72 ± 6.82	13.42 ± 7.09 (n = 449)	14.95 ± 6.90 (n = 149)	0.040
APTT	33.32 ± 20.06	32.46 ± 19.25 (n = 301)	35.80 ± 22.67 (n = 89)	0.034
INR	1.08 ± 0.82	1.07 ± 0.88 (n = 445)	1.14 ± 0.55 (n = 149)	0.308

Number in brackets are shown in percentage

73.67%, 88.31% of admitted patients. Subcutaneous low molecular weight heparin (LMWH), injection Dexamethasone, Empirical parenteral antibiotic, remdesivir and tocilizumab were given in 65.70%, 63.46%, 41.45%. 21.40% and 4.55% patients respectively. Treatment details of the study population has been shown in Table 2.

To determine factors associated with severe COVID-19 infections, a univariate and multivariate logistic regression was applied. The odds of patients getting severe disease in univariate analysis were age > 60 years (OR: 3.610, (95% CI 2.558–5.0952), < 0.00), presence of diabetes (OR: 2.365, 95% CI (1.690–3.309), < 0.00), CKD (OR: 4.600, 95% CI (2.332– 9.076) < 0.00), NLR > 3.3 (OR: 3.914, 95% CI (2.457–6.236), < 0.000), CRP > 100 (OR: 3.914, 95% CI (2.457–6.236), < 0.000), D-Dimer (OR: 5.540, 95% CI (3.514––8.821), < 0.000) and serum ferritin >300 ng/mL (OR: 5.633, 95% CI 3.257–10.177, < 0.00). In multivariate analysis only age more than 60 years (AOR: 2.114, 95% CI (1.05–4.254), 0.036), neutro-

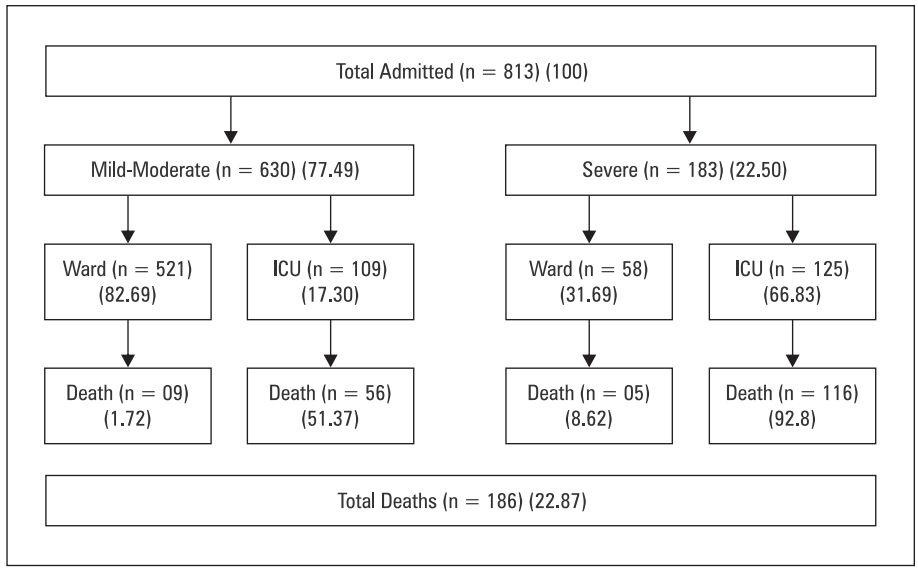


Figure 2. Flow chart of study patients

Table 2. Type of treatment received by COVID-19 patients

	Total (n = 813)	Mild-Moderate (n = 630)	Severe (n = 183)	P value
Ward	579 (71.21)	521 (82.69)	58 (9.20)	< 0.0001
ICU	234 (28.78)	109 (17.30)	125 (68.30)	< 0.0001
NIV	85 (10.45)	42 (6.66)	43 (23.49)	< 0.00001
Mechanical ventilation	65 (7.99)	26 (4.12)	39 (21.31)	< 0.00001
HCQ	596 (73.67)	503 (79.84)	93 (50.81)	< 0.00001
Azithromycin	718 (88.31)	563 (89.36)	155 (84.69)	0.083
LMWH	546 (65.70)	432 (68.57)	114 (62.29)	0.111
Inj Dexona	516 (63.46)	370 (58.73)	146 (79.78)	< 0.00001
Parenteral Antibiotic	337 (41.45)	180 (28.57)	157 (85.79)	< 0.00001
Remdesivir	174 (21.40)	87 (13.80)	87 (47.54)	< 0.00001
Tocilizumab	37 (4.55)	08 (1.26)	29 (15.84)	< 0.00001
Convalescent plasma	44 (5.41)	09 (1.42)	35 (19.12)	< 0.00001

Number in bracket shows proportion

phil-lymphocyte ratio (NLR) more than 3.3 (AOR: 1.082, 95% CI (1.030–1.137), 0.002) and D-Dimer > 1 μg/mL (AOR: 2.999 (1.464–6.146),0.003 were found statistically significant (Table 3).

ROC curve for individual factor depicted in Figure 3. Neutrophil-lymphocyte ratio (NLR) emerged as most predictive factor for mortality among COVID-19 patients (AUC 79.3%) among other factors. Regression model analysis found, age more than 60 years, presence of breathlessness, severe disease or presence of chronic kidney disease as predictor of mortality in COVID-19 infections (Table 4).

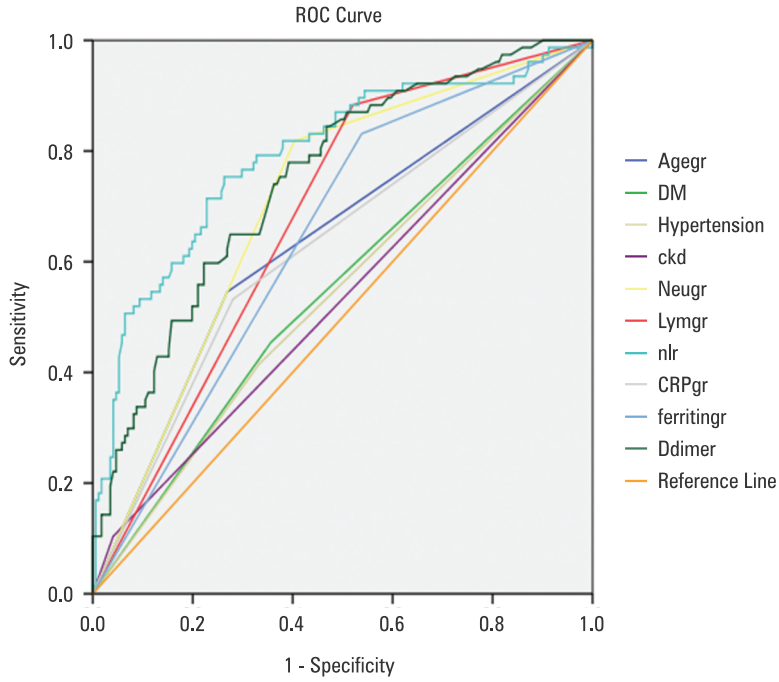
Discussion

We analysed data from our population of patients needing admission to a dedicated Covid tertiary care hospital in eastern part of India. Demographic distribution of our set of patients follows the trend noted by some other authors. Mean age of affected patients was 50.9 years in our group versus 50.7 years as reported by Kayina and colleagues [11]. In their cohort of 235 patients, they found 68.1% male preponderance. We have noted a much higher proportion of male admissions at 78.59%. This could be due to the

Table 3. Logistic regression model for factor associated with severe COVID-19 infections

Variable	Univariate analysis		Multivariate analysis	
	OR	95% of CI, P value	AOR	95% of CI, P-value
Age > 60 years	3.610	2.558–5.0952), < 0.00	2.114	1.05–4.254), **0.036**
Diabetes	2.365	1.690–3.309), < 0.00	0.722	0.351–1.485), 0.375
Hypertension	2.69	1.884–3.828), < 0.00	0.928	(0.443–1.946), 0.844
CKD	4.600	(2.332–9.076) < 0.00	1.116	(0.304–4.093), 0.868
Neutrophilia > 80%	5.491	3.757–8.026), < 0.000	1.253	(0.369–4.256), 0.718
Lymphopenia < 20%	6.022	3.890–9.322), < 0.00	1.504	(0.422–5.349), 0.528
NLR > 3.30	5.645	3.511–9.399), < 0.000	1.082	1.030–1.137), **0.002**
CRP > 100 mg/L	3.914	2.457–6.236), < 0.000	1.017,	(0.493–2.099), 0.963
D- dimer > 1.00 μg/mL	5.54	3.514–8.821), < 0.000	2.999	1.464–6.146), **0.003**
Serum ferritin > 300 μg/L	5.633	3.257–10.177, < 0.00	1.307	0.569–3.001), 0.528

CKD — chronic kidney disease; NLR — neutrophil lymphocyte ratio; AOR — adjusted odd ratio



Area under the curve

Test Result Variable(s)	Area
Age > 60	.638
DM	.549
Hypertension	.541
CKD	.531
Neut > 80%	.707
Lymph < 20%	.681
NLR > 3.3	.793
CRP > 100	.626
Ferritin > 300	.647
D dimer > 1	.750

Figure 3. ROC for individual factors as predictors in logistic model with AUC

socio-cultural practices and a patriarchal societal nature of the poor rural population to which our institute caters.

Severity of disease on admission showed that 183 (22.50%) patients presented to us with severe Covid infection. This is an important determinant of morbidity and mortality as it could reflect delay in initiation of management. Zhou C et al. [12] have reported similar proportion of patients presenting with severe infection (22.76%) on admission. Zhang and colleagues [13] however noted a higher incidence at (41.42%) but they had a smaller sample size of 140 patients. Gender did not appear to have any adverse effect on severity of disease on admission in our study or even that by Zhang et al.

Analysing the clinical characteristics, we noted that regardless of severity of disease, most com-

Table 4. Logistic regression model to predict mortality of COVID-19 infection

Variable	Adjusted odds ratio with 95% CI	Z-statistic	P-value
Age > 60 years	1.56 (1.05–2.34)	2.19	0.029
Severe disease	29.43 (17.35–49.93)	12.54	0.0001
Moderate cases	1.96 (1.20–3.19)	2.71	0.007
Shortness of Breath	2.13 (1.43–3.15)	3.75	0.0001
CKD	3.23 (1.56–6.67)	3.16	0.002

mon symptoms on admission were fever (75.39%), cough (67.28%) and dyspnoea (42.69%). Bhandari et al. [9] have reported fever in 55.90%, cough in 52.75% and shortness of breath in 46.45% of the 127 symptomatic patients they have studied. We have a slightly higher percentage of patients presenting with fever and cough. Dyspnoea was found significantly higher in patients with severe COVID-19 infections in all studies and is an indicator of severe COVID-19 [14]. It is our institutional protocol to try and trace the source of the Covid positive patients. In our analysis, we were able to find a definite source in 72 (8.75%) patients only. Furthermore, pre-existing co morbidities can complicate course of any illness. Our study found almost half of Covid patients (50.92%) requiring admission for Covid management had at least one comorbidity. Similar incidences (46.1%) have been reported by other authors but an Indian study by Soni et al. [8], showed that a lower proportion (28.1%) of patients had co morbidities. This difference could be because admission criteria are different in the two hospitals. In our institute, only patients needing oxygen support were being admitted.

We also found that presence of comorbidity was significantly higher in severe Covid patients compared to mild-moderate infections (74.31 *vs.* 44.12%, $p < 0.0001$). Diabetes, Hypertension, CAD & CKD were the most common comorbidities found in 32.96%, 30.13%, 6.15% and 4.42% respectively in this study. This could be important predictors for progression of disease to severe form. Based upon our results, patients with diabetes, hypertension, CAD and CKD should be tested and managed more aggressively as they do predict progression to severe forms. This finding has been corroborated by previous report [15].

Severe disease is associated with high levels of inflammatory mediators such as elevated C-reactive protein, lactate dehydrogenase, ferritin, IL-6 apart from neutrophilia and lymphopenia. All these abnormalities suggest that SARS-CoV-2 infection may be associated with a 'cytokine storm', which could play an important role in disease severity [16–18].

With regard to factors associated with severity of disease, we found age > 60 years, presence of diabetes, hypertension, CKD, elevated NLR, CRP, D dimer and serum ferritin to be associated with significantly higher risk to develop severe COVID-19 infection in univariate analysis. However, in multivariate analysis Age more than 60 years, NLR more than 3.3 and D dimer of more than 1 increases the risk of severe Covid 19 infections. Our finding similar to observation by Ashish Bhargava et al. [19] who did not find pre-existing hypertension as the independent risk factor for severe illness. Another study by Enrico Maria Trecarichi et al. [20]. did not found hypertension as the risk factor for the mortality in hospitalised patients.

Inflammation plays a significant role in COVID-19 infection. Several circulating biomarkers that can represent inflammation and immune status are potential predictors of COVID-19 disease severity. Elevated leucocyte counts and neutrophilia were prominent characteristics of the severe patients in our study. This is consistent with a meta-analysis, which reported higher white blood cell counts in patients with severe COVID-19 infection [21–22]. Several studies implicate lymphopenia to be a poor prognostic marker [23–24]. Viral infections are generally associated with lymphocytosis, however as the SARS-CoV-2 viral receptor, angiotensin converting enzyme 2 (ACE 2) is expressed on lymphocytes, the virus attack causes lymphopenia [21]. In the meta-analysis of Zeng et al. [19] higher neutrophil levels were associated with more severe infections. This is consistent with our findings too. Our study also showed eosinopenia were significantly higher in patients with severe COVID-19 infections. This finding has been reported earlier by some authors too [25, 26].

There are several studies highlight the relevance of Neutrophil lymphocyte ratio (NLR) as prognostic marker [27]. NLR in our study was found as an independent risk factor for severe disease on multivariate analysis. Similarly, a study by Jingyuan Liu et al. [28] and one metanalysis [29] shown that the NLR as independent risk factors for severe COVID-19 disease.

Finally, to analyse the treatment outcomes, all-cause mortality of admitted Covid patients during our study period was 22.87%. Patients with severe infection had significantly higher mortality in comparison with patients with mild-moderate infection (66.21% *vs.* 10.21%). More than half (56.49%) of patients who required ICU admission, succumbed to the disease. This appears higher than some other reports of 43.5% [21], however, since our institute was amongst the very few hospitals admitting sick Covid patients for a very large catchment area, many patients with multi organ dysfunction or poor APACHE scores on admission were catered. We believe this could be a possible cause for the slightly different outcomes. This study found age more than 60 years, presence of breathlessness, severe disease or patient with chronic kidney disease are risk factor for mortality in COVID-19 infections. Du RH et al. [30] have documented presence of dyspnea, fatigue, was significantly associated with higher risk of mortality in COVID-19. Our study supported by Indian study showed presence of dyspnoea significantly increased the risk of mortality [31]. It was found that patients with chronic comorbidities were associated with a severe COVID-19 infection with higher mortality [32].

The strength of this study is a large cohort of COVID-19 patients which we have studied in detail. Demographic details, clinical parameters, lab workup, treatment given have all been noted and analysed. The main limitation of the study was study design of retrospective record search based.

Conclusions

Regardless of severity of disease, most common symptoms on admission were fever (75.39%), cough (67.28%) and dyspnea (42.69%). Dyspnea was found significantly higher in patients with severe COVID-19 infections. We also found that presence of comorbidity was significantly higher in severe Covid patients compared to mild-moderate infections.

All-cause mortality of admitted Covid patients during our study period was 22.87%. Patients with severe infection had significantly higher mortality in comparison with patients with mild-moderate infection (66.21% *vs.* 10.21%). More than half (56.49%) of patients who required ICU admission, succumbed to the disease.

Factors like elderly age (age > 60 years), elevated NRL, CRP, D-Dimer and serum ferritin were associated with significantly higher risk to develop severe COVID-19 infections.

Age more than 60 years, presence of breathlessness, severe disease or presence of chronic kidney disease as predictor of mortality in COVID-19 infections

Conflict of interest

None to declared.

References

4. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395(10223): 497–506, doi: 10.1016/S0140-6736(20)30183-5, indexed in Pubmed: 31986264.
5. Liu K, Fang YY, Deng Y, et al. Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province. Chin Med J (Engl). 2020; 133(9): 1025–1031, doi: 10.1097/CM9.0000000000000744, indexed in Pubmed: 32044814.
6. https://www.worldometers.info/coronavirus/ (25-03-2021).
7. Zhang JJ, Cao YY, Tan Ge, et al. Clinical, radiological, and laboratory characteristics and risk factors for severity and mortality of 289 hospitalized COVID-19 patients. Allergy. 2021; 76(2): 533–550, doi: 10.1111/all.14496, indexed in Pubmed: 32662525.
8. Zhang J, Wang X, Jia X, et al. Risk factors for disease severity, unimprovement, and mortality in COVID-19 patients in Wuhan, China. Clin Microbiol Infect. 2020; 26(6): 767–772, doi: 10.1016/j.cmi.2020.04.012, indexed in Pubmed: 32304745.
9. Du H, Dong X, Zhang JJ, et al. Clinical characteristics of 182 pediatric COVID-19 patients with different severities and allergic status. Allergy. 2021; 76(2): 510–532, doi: 10.1111/all.14452, indexed in Pubmed: 32524611.
10. Liu J, Li S, Liu J, et al. Longitudinal characteristics of lymphocyte responses and cytokine profiles in the peripheral blood of SARS-CoV-2 infected patients. EBioMedicine. 2020; 55: 102763, doi: 10.1016/j.ebiom.2020.102763, indexed in Pubmed: 32361250.
11. Soni SL, Kajal K, Yaddanapudi LN, et al. Demographic & clinical profile of patients with COVID-19 at a tertiary care hospital in north India. Indian J Med Res. 2020 [Epub ahead of print]; 153(1 & 2): 115–125, doi: 10.4103/ijmr.IJMR_2311_20, indexed in Pubmed: 33208558.
12. Bhandari S, Singh A, Sharma R, et al. Characteristics, treatment outcomes and role of hydroxychloroquine among 522 COVID-19 hospitalized patients in Jaipur City: An epidemio-clinical study. J Assoc Physicians India. J Assoc Physicians India. 2020; 68(6): 13–19, indexed in Pubmed: 32610873.
13. Ministry of Health and Family Welfare (Government of India). Clinical Management Protocol: COVID-19 (Version 3), June 13, 2020.
14. Kayina CA, Haritha D, Soni L, et al. Epidemiological & clinical characteristics & early outcome of COVID-19 patients in a tertiary care teaching hospital in India: A preliminary analysis. Indian J Med Res. 2020; 152(1 & 2): 100–104, doi: 10.4103/ijmr.IJMR_2890_20, indexed in Pubmed: 32811801.
15. Zhou C, Huang Z, Tan W, et al. Predictive factors of severe coronavirus disease 2019 in previously healthy young adults: a single-center, retrospective study. Respir Res. 2020; 21(1): 157, doi: 10.1186/s12931-020-01412-1, indexed in Pubmed: 32571410.
16. Zhang JJ, Dong X, Cao YY, et al. Clinical characteristics of 140

patients infected with SARS-CoV-2 in Wuhan, China. Allergy. 2020; 75(7): 1730–1741, doi: 10.1111/all.14238, indexed in Pubmed: 32077115.
17. Wang D, Hu Bo, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020; 323(11): 1061–1069, doi: 10.1001/jama.2020.1585, indexed in Pubmed: 32031570.
18. Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020. World Health Organization, 2020.
19. Wu C, Chen X, Cai Y, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Intern Med. 2020; 180(7): 934–943, doi: 10.1001/jamainternmed.2020.0994, indexed in Pubmed: 32167524.
20. Channappanavar R, Perlman S. Pathogenic human coronavirus infections: causes and consequences of cytokine storm and immunopathology. Semin Immunopathol. 2017; 39(5): 529–539, doi: 10.1007/s00281-017-0629-x, indexed in Pubmed: 28466096.
21. Pedersen SF, Ho YC. SARS-CoV-2: a storm is raging. J Clin Invest. 2020; 130(5): 2202–2205, doi: 10.1172/JCI137647, indexed in Pubmed: 32217834.
22. Bhargava A, Fukushima EA, Levine M, et al. Predictors for severe COVID-19 Infection. Clin Infect Dis. 2020; 71(8): 1962–1968, doi: 10.1093/cid/ciaa674, indexed in Pubmed: 32472676.
23. Trecarichi EM, Mazzitelli M, Serapide F, et al. IDTM UMG COVID-19 Group. Clinical characteristics and predictors of mortality associated with COVID-19 in elderly patients from a long-term care facility. Sci Rep. 2020; 10(1): 20834, doi: 10.1038/s41598-020-77641-7, indexed in Pubmed: 33257703.
24. Zeng F, Li L, Zeng J, et al. Can we predict the severity of coronavirus disease 2019 with a routine blood test? Pol Arch Intern Med. 2020; 130(5): 400–406, doi: 10.20452/pamw.15331, indexed in Pubmed: 32356642.
25. Bastug A, Bodur H, Erdogan S, et al. Clinical and laboratory features of COVID-19: predictors of severe prognosis. Int Immunopharmacol. 2020; 88: 106950, doi: 10.1016/j.intimp.2020.106950, indexed in Pubmed: 32919217.
26. Lei F, Liu YM, Zhou F, et al. Longitudinal association between markers of liver injury and mortality in COVID-19 in China. Hepatology. 2020; 72(2): 389–398, indexed in Pubmed: 32359177.
27. Terpos E, Ntanasis-Stathopoulos I, Elalamy I. Hematogical findings and complications of COVID-19. Am. J. Hematol. 2020.
28. Xie G, Ding F, Han L, et al. The role of peripheral blood eosinophil counts in COVID-19 patients. Allergy. 2021; 76(2): 471–482, doi: 10.1111/all.14465, indexed in Pubmed: 32562554.
29. Zhao L, Zhang YP, Yang X, et al. Eosinopenia is associated with greater severity in patients with coronavirus disease 2019. Allergy. 2021; 76(2): 562–564, doi: 10.1111/all.14455, indexed in Pubmed: 32544252.
30. Ying HQ, Deng QW, He BS, et al. The prognostic value of preoperative NLR, d-NLR, PLR and LMR for predicting clinical outcome in surgical colorectal cancer patients. Med Oncol. 2014; 31(12): 305, doi: 10.1007/s12032-014-0305-0, indexed in Pubmed: 25355641.
31. Liu J, Liu Y, Xiang P, et al. Neutrophil-to-lymphocyte ratio predicts critical illness patients with 2019 coronavirus disease in the early stage. J Transl Med. 2020; 18(1): 206, doi: 10.1186/s12967-020-02374-0, indexed in Pubmed: 32434518.
32. Emile S, Khan S. Predictors of severe and critical COVID-19: A systematic review. World J Clin Infect Dis. 2020; 10: 24–32.
33. Du RH, Liang LR, Yang CQ, et al. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. Eur Respir J. 2020; 55(5), doi: 10.1183/13993003.00524-2020, indexed in Pubmed: 32269088.
34. Jain Kumar S, Dudani A, Jaiswal N, et al. Assessment of clinical profile & risk factors associated with adverse outcome in COVID-19 patients at a tertiary care hospital in central India - A retrospective record based study . J Assoc Physicians India. 2021; 69(4): 27–31, indexed in Pubmed: 34170654.
35. Zhang JJ, Dong X, Cao YY, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. Allergy. 2020; 75(7): 1730–1741, doi: 10.1111/all.14238, indexed in Pubmed: 32077115.