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Clinico-Demographic Characteristics and Laboratory Parameters Correlation with Severity Spectrum in COVID-19 Patients at a Peripheral Hospital of Indian Armed Forces

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Abstract: ***Background*: This study was conducted to describe the clinico-demographic characteristics and the laboratory parameters in symptomatic patients of COVID-19 from a peripheral hospital of Indian Armed Forces and to identify predictors of severity in COVID-19. *Methodology*: The study included consecutive 161 lab confirmed symptomatic cases between 05 Jul and 10 Oct 2020. Bivariate and multivariate logistic regression analysis of demographic, clinical and laboratory data was done to find predictors of severity in COVID-19. *Results*: The age of our patients ranged from 01 to 69 with male to female ratio of 8.47%. The clinical spectrum of 161 symptomatic patients included in the study showed mild, moderate, and severe disease in 81.37%, 15.53% and 3.11% respectively. There were two (CFR=1.18%) deaths. Diabetes Mellitus was the most commonly observed comorbidity. Fever was the most common presenting symptom. Baseline N/L ratio > 3 and CRP positivity was seen in 13 (8.07%) patients with specificity and PPV of 100% for progression in severity spectrum. *Conclusion*: In our study, we recommend that age > 40 years, any comorbidity, and baseline raised ESR, renal functions, random blood sugar, and N/L ratio > 3 with positive CRP be used as the predictors for higher severity in COVID-19 patients.***

Keywords: COVID-19; Severity Spectrum; Predictors; Clinico-Demographic; Laboratory Parameters; Peripheral Hospital

1. Tables and Figures

Results Table

Table 1: Demographic Characteristics and Severity Spectrum of COVID-19 of study population

Variables	*Total (n=161)*	*Mild disease (n=131)*	*Moderate disease (n=25)*	*Severe disease (n=5)*	*p value* *Mild vs Moderate/Severe Disease*
Age (years)	30 (23-44)	28 (23-41)	40 (30-47.5)	51 (48.5-64.5)	<0.001
Sex					
Male	144	118 (82.5%)	23 (16.1%)	03 (2.1%)	0.09
Female	17	13 (76.5%)	02 (11.8%)	02 (11.8%)	
Comorbidities					
Single comorbidity	09	03 (33.3%)	06 (66.7%)	00	<0.001
>1 comorbidity	13	05 (38.5%)	03 (23.1%)	05 (38.5%)	
Any Comorbidity	22	08 (36.4%)	09 (40.9%)	05 (22.7%)	
Blood group					
A	38	30 (78.9%)	07 (18.4%)	01 (2.6%)	0.83
B	52	41 (78.8%)	08 (15.4%)	03 (05.8%)	
AB	23	19 (82.6%)	04 (17.4%)	00	
O	48	41 (85.4%)	06 (12.5%)	01 (2.1%)	
Rh typing					
Positive	153	124 (81%)	24 (15.7%)	5 (3.3%)	0.84
Negative	08	07 (87.5%)	01 (12.5%)	00	
Total days of Illness (in days)	06 (03.5-08.5)	05 (03-07)	12 (10-15.5)	15 (07-31) (n=03)	<0.001
Total days of Hospitalisation (in days)	09 (05-13)	08 (05-10)	15 (12.5-18.5)	17 (16.5-25.5)	<0.001
Data is expressed as median (IQR) or row percentages. Categorical variables were analysed using *χ^2 test and continuous variables using Independent samples t test.					

Table 2: Analysis of Clinical features and intervention modalities with severity of disease

Variables	*Total (n=161)*	*Mild disease (n=131)*	*Moderate disease (n=25)*	*Severe disease (n=5)*	*p value* *Mild vs Moderate/Severe Disease*
Clinical Features					
Fever	125 (77.6%)	99 (79.2%)	22 (17.6%)	05 (4.0%)	0.166
Cough	75 (46.6%)	59 (78.7%)	11 (14.7%)	05 (6.7%)	0.052
Headache	81 (50.3%)	63 (77.8%)	15 (18.5%)	03 (3.7%)	0.5

Bodyache	112 (69.6%)	85 (75.9%)	22 (19.6%)	05 (4.5%)	0.02
Running nose	08 (5.0%)	07 (87.5%)	01 (12.5%)	00	0.84
Sore throat	61 (37.9%)	51 (83.6%)	08 (13.1%)	02 (3.3%)	0.80
Diarrhea	16 (9.9%)	10 (62.5%)	04 (25%)	02 (12.5%)	0.03
Dyspnea	02 (7.4%)	00	02 (100%)	00	<0.001
Anosmia	04 (2.5%)	04 (100%)	00	00	0.62
Altered taste	06 (3.7%)	04 (66.7%)	02 (33.3%)	00	0.44
Chest pain	02 (1.2%)	01 (50%)	01 (50%)	00	0.395
Lethargy	13 (8.1%)	07 (53.8%)	06 (46.2%)	00	0.006
Abdominal pain	11 (6.8%)	07 (63.6%)	02 (18.2%)	02 (18.2%)	0.01
Interventions					
Azithromycin	36 (22.4%)	27 (75%)	08 (22.2%)	01 (2.8%)	- -
Hcq	33 (20.5%)	11 (33.3%)	19 (57.6%)	03 (9.1%)	- -
Methyl prednisolone	23 (14.3%)	00	18 (78.3%)	05 (21.7%)	- -
Lmwh	24 (14.9%)	03 (12.5%)	16 (66.7%)	05 (20.8%)	- -
Favipiravir	16 (9.9%)	02 (12.5%)	11 (68.8%)	03 (18.7%)	- -
Remdesivir	10 (6.2%)	00	05 (50%)	05 (50%)	- -
Oxygen	14 (8.7%)	00	09 (64.3%)	05 (35.7%)	- -
Iv antibiotics	32 (19.9%)	02 (6.3%)	25 (78.1%)	05 (15.6%)	- -
Data is expressed as row percentages. Categorical variables were analysed using *χ^2 test. The various intervention modalities were not analysed for significant correlation due to observer's bias.					

Table 3: Laboratory Parameters with Disease severity

Variables	***Total (n=161)***	***Mild disease (n=131)***	***Moderate disease (n=25)***	***Severe disease (n=5)***	***p value Mild vs Moderate/ severe disease***
Haemoglobin (g/dl)	14.6 (13.5-15.4)	14.7 (13.6-15.5)	14.3 (12.4-14.9)	13.5 (10.8-14.2)	0.13
White blood cells (per mm^3)	5000 (4250-6200)	4800 (4000-5700)	6200 (4600-8450)	7800 (6350-11400)	**<0.001**
Neutrophil count (%)	54 (46.5-63)	53 (46-58)	68 (55.5-72)	78 (74-85)	**<0.001**
Lymphocyte count (%)	34 (26-40)	36 (30-40)	24 (20-33)	16 (10-19)	**<0.001**
Neutrophil to Lymphocyte ratio	1.59 (1.1-2.5)	1.44 (1.1-1.9)	2.8 (1.7-3.6)	4.88 (3.9-8.5)	**<0.001**
ESR (mm in 1st hour)	08 (06-12)	08 (5.7-12)	10 (08-16)	42 (28.5-52.5)	**<0.001**
Bilirubin (mg/dl)	0.8 (0.6-1.1)	0.8 (0.6-1.1)	1.0 (0.6-1.1)	1.0 (0.6-1.4)	0.19
AST (IU/L)	31 (24-40)	31 (24-39)	36 (26-51)	45 (22.5-72)	0.09
ALT (IU/L)	28 (22-40)	28 (22-38)	34 (22-46)	40 (17.5-59.5)	0.16
Urea (mg/dl)	26 (24-30)	26 (24-30)	28 (24-31.5)	32 (29-44)	**<0.001**
Creatinine (mg/dl)	0.8 (0.7-0.9)	0.8 (0.7-0.9)	0.9 (0.7-1.0)	1.1 (0.9-1.2)	**0.002**
Platelet count (per mm^3)	198 (167-233.5)	194 (165-228)	199 (163-293.5)	208 (188.5-253.5)	0.11
Random Blood Sugar (mg/dl)	100 (87-123)	98 (88-115)	106 (75-167)	186 (111.5-238.5)	**<0.001**
***C-reactive protein**					
Positive	25 (15.5%)	3 (12%)	17 (68%)	5 (20%)	**<0.001**
Negative	136 (84.5%)	128 (94.1%)	8 (5.9%)	00	
Data is expressed as median (IQR) or row percentages. Categorical variables were analysed using *χ^2 test and continuous variables using Independent samples t test.					

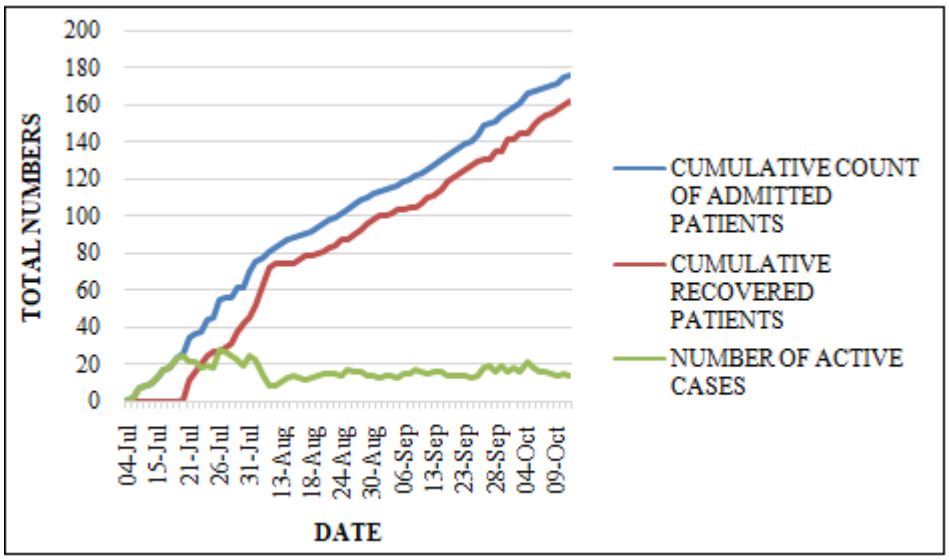
Table 4: Predictive values for N/L Ratio and CRP with disease severity

	N/L Ratio > 3 and CRP Positive	*Either N/L Ratio < 3 or CRP Negative or both*	*Total*	
Mild Disease	00	131	131	Specificity = 100%
Moderate or Severe Disease	13	17	30	Sensitivity = 43.3%
Total	13	148	161	
	PPV = 100%	NPV = 88.5%		

Table 5: Multivariate analysis of mild vs moderate/severe severity with various factors

Variables	***Unadjusted Odds Ratio***	***Adjusted Odds Ratio***	***p-value***
Male gender	1.40 (0.42-4.63)	1.85 (0.22-15.23)	0.56
Having any one comorbidity	15.30 (3.50-67.60)	16.73 (2.45-113.90)	**0.04**
Having >01 comorbidity	12.30 (3.60-42.20)	8.12 (1.83-35.88)	**0.006**
Cough	0.72 (0.32-1.60)	1.19 (0.38-3.74)	0.76
Body ache	0.21 (0.06-0.71)	17.20 (1.71-172.62)	**0.01**
Diarrhoea	0.33 (0.11-0.99)	4.25 (0.91-19.76)	**0.06**
Dyspnoea	0.01 (0.002-0.11)	217.60 (10.36-4570.40)	**0.001**
Lethargy	0.23 (0.07-0.73)	2.20 (0.40-12.24)	0.36
Abdominal pain	0.40 (0.10-1.34)	0.81 (0.04-17.94)	0.89

Graph



Graph 1: Graph depicting cumulative figures of COVID-19 patients at our hospital

1. Introduction

COVID-19 (**CO**rona**VI**rus**D**isease 20**19**) is caused by enveloped, single stranded RNA beta-coronavirus named SARS CoV 2 (1) . It has its origin in cluster of patients with pneumonia of unknown cause in the Wuhan city of China, in December 2019 (2) . Since then this nanometre sized contagion has spread across the borders at a rapid pace threatening not only the economies but also posing challenges to the health care infrastructure of India and superpowers of the world (3) . WHO declared it as a public health emergency of international concern on 30 January 2020 and a pandemic on 11 Mar 2020 (4) . In India, the first confirmed case of COVID-19 was detected on 30 Jan 2020 at General Hospital, Thrissur, Kerala (5) . Since then, this disease in India has infected more than 6 million people with doubling rate of 36.5 days. The disease cure rate has been good at 83%, however, approximately 95 thousand (CFR 1.56%) have succumbed to this contagion with cured to death ratio of 53% as on 29 Sep 2020 (6) . The clinical presentation of the disease includes asymptomatic, pre-symptomatic, symptomatic individuals (7) . The clinical severity of these symptomatic individuals can range from mild cases with cough and sore throat to moderate cases with breathlessness, high grade fever and pneumonia to severe cases with ARDS and Sepsis (8) . It is due to these asymptomatic and pre-symptomatic individuals, who are ambulant and can spread the infection to other people, and also the lack of evidence based treatment or a vaccine, the whole world is facing the challenge to control this pandemic (9). The major pathogenesis in moderate and severe COVID-19 has been the dysregulated immune system and cytokine storm (10) and severe endothelial injury along with widespread thrombosis and microangiopathy (11) . Hence, various trials and studies have been conducted which have recommended systemic corticosteroids (CoDEX trial) (12) and anticoagulation (13) as to reduce mortality and progression in COVID-19. Till now, no other specific treatment has been licensed by Drug Controller General of India (DCGI) for COVID-19. The treatment is primarily supportive with IV Antibiotics, systemic corticosteroids, anticoagulants and Oxygen support whenever required on case to case basis. With the paucity of directly acting anti-virals against SARS CoV 2, much attention has been diverted to repurposed drugs like Hydroxychloroquine, Favipiravir and Remdesivir (14) . The trials on other possible preventive or therapeutics arms like convalescent plasma therapy, monoclonal antibodies, anti-viral drugs and vaccines are also ongoing for combating this disease (15) . In the meanwhile, healthcare workers are working tirelessly and trying to formulate management guidelines to combat the disease even with the high risk of contracting disease due to repeated occupational exposure (16) . Most of the available data on COVID 19 is from tertiary care hospitals in metro cities of India. This study was conducted to find clinico-demographic characteristics and laboratory parameters to predict mild vs moderate-severe in the severity spectrum of COVID-19 disease at any point of time at a resource constraint peripheral hospital for identification of at-risk individuals and in turn to reduce the morbidity and mortality by imparting timely therapy.

2. Material and Methods

2.1 Study Design

This single centre, prospective, observational study was done at a peripheral hospital of Indian Armed Forces at Goa. The medical facilities at this hospital caters to the clientele population of approximately 8000 which includes serving and retired personnel of Indian Armed Forces and/or their dependants. The first lab confirmed case of COVID 19 was admitted on 05 July 2020. Since then, out of a total of approximately 1300 patients presenting with symptoms of Influenza Like Illness (ILI) between 05 Jul to 10 Oct 2020, 774 patients were tested by RT-PCR based TrueNat testas per the criteria laid down by ICMR (updated time to time) (17) . Atotal of 169 patients tested positive for SARS CoV 2 by TrueNat test. Out of these 169 patients, 08 patients were asymptomatic who were tested because of close contact with a lab confirmed COVID positive case.161 patients who were symptomatic were admitted and consecutively enrolled in this study for analysis.

2.2 Data Collection

A Written informed consent was obtained from all patients before inclusion in the study. No sensitive information like names and ranks of patients or name of the hospital was included in the data tables or study. Appropriate permission was obtained from the hospital Commanding Officer and the Naval Headquarters.

The demographic data of all patients which included their name, age, gender, blood group, co-morbidities and contact history was collected at the time of their swab collection. The data of clinical and laboratory parameters was collected from the medical records of these patients. The clinical parameters included the symptom (s) on the first day of illness, the dates of symptom onset, complete resolution, admission to hospital, discharge from hospital and the treatment given.

All patients received symptomatic treatment with paracetamol, levo-cetrizine, diphenhydramine on case-to-case basis along with off-label use of vitamin C, zinc and vitamin D. The patients with co-morbidities were continued on pre-existing treatment with addition of basal-bolus insulin for controlling steroid induced hyperglycemia. Patients with symptoms of mild URTI were given Azithromycin and/or Hydroxychloroquine (HCQ), if there were no contraindications. IV Antibiotics (Ceftriaxone plus Clarithromycin) were started in patients with persistent fever spikes for > 3days. Favipiravir with corticosteroids and low molecular weight heparin (LMWH) was instituted to patients with regular fever spikes for further > 3 days while on IV Antibiotics and with raised inflammatory markers i. e. neutrophil to lymphocyte ratio > 3, raised ESR and CRP positive. Treatment with Favipiravir was changed to Remdesivir with continuation of IV Antibiotics, corticosteroids and LMWH in all patients progressing to hypoxemia requiring oxygen inhalation or ventilatory support. Oxygen supplementation in hypoxemic patients was done via nasal prongs, face mask, non-rebreathing mask, or ventilatory support with non-invasive/ invasive ventilation along with COVID awake repositioning/ proning (CARP) protocol. All these medications were used on the case-to-case basis with emergency use authorisation granted by DCGI for 'off label' use and after obtaining written consent from the patient for same.

All patients underwent testing for hematological, biochemical and serological parameterswhich included hemoglobin, TLC, DLC, platelet count, ESR, random blood sugar, urea, creatinine, bilirubin, AST, ALT and CRP (qualitative) on the day of admissions and repeated on case to case basis. Neutrophil to Lymphocyte ratio (N/L ratio) was obtained by dividing the Neutrophil percentage by Lymphocyte percentage in DLC. Only parameters of the day of admission were included for the purpose of analysis.

The patients were discharged from the hospital only after 10^{th} day of the onset of symptoms and at least 3 days of asymptomatic period or stoppage of all kind of COVID related treatment/ oxygen supplementation which ever was later.

All patients were categorised in to sub-groups based on their documented clinical outcome at the time of their primary outcome which was either discharge from the hospital or death due to COVID-19 or its related complications. These sub-groups which included mild, moderate, severe disease and death, were defined as per the updated clinical management guidelines for COVID 19 issued by MoHFW (updated time to time) (8) .

2.3 Statistical Analysis

Statistical analysis was carried out using Statistical Package for the Social Sciences 21 and Microsoft Excel 2019. All quantitative data such as age, haemodynamic parameters, laboratory values and days of illness were estimated using measures of central location (mean, median and Inter Quartile Range). Qualitative or categorical variables were described as proportions. The Mann-Whitney *U* test, Fisher's exact test, $\chi 2$ test, and Yates' continuity correction were applied to analyse the differences between groups according to the type of data. Bivariate and multivariate logistic regression analyses were performed to analyse the effect of categorical variables (gender, having comorbidity and clinical features) for mild vs moderate/severe COVID-19 disease. The data of various Intervention modalities was not included in analysis due to observer's bias. Backward conditional multivariable logistic regression analysis was done using variables which showed significance of ($p<0.1$) in univariate analysis.

3. Results

The demographic characteristics of 161consecutive symptomatic patients who tested positive for SARS CoV 2 by TrueNat test between 05 Jul to 10 Oct 2020and were included in the study are depicted in Table 1. Cumulative case count of positive patients, recovered patients and active patients at any given point of time is shown in Figure 1.

The patients age ranged from 01 to 69 years. The age distribution curve was left skewed by 0.475. The male and female ratio was 8.47. B+ (n=50; 31.1%) was the most common blood group. Diabetes Mellitus (n=17; 10.0%) was the most commonly observed comorbidity followed by Primary Hypertension (n=12; 7.1%).

Out of 161symptomatic patients, 131 (81.4%) had mild, 25 (15.5%) moderate and 5 (3.1%) had severe disease. This includes 11 (6.8%) healthcare workers (HCW) who got infected after contact in their OPDs, non-COVID wards or emergency room with individuals who became symptomatic and tested positive after 2-3 days. None of the HCW who were on duty in COVID isolation ward of our hospital have tested positive till date. Out of 30 patients in moderate and severe category, only 02 patients were admitted on emergency basis due to hypoxemia at the time of admission.

The presenting symptoms and treatment imparted to study population are depicted in Table 2. Fever was the most common presenting symptom in 125 (77.6%) patients. Fever was also the most common presenting symptom in patients with underlying Diabetes (n=12 of 17, 70.6%), and Primary Hypertension (n=11 of 12, 91.7%). Azithromycin (n=36;

22.4%) and/or HCQ (n=33; 20.5%) were given in patients who had mild symptoms persistent for more than 5 days after ruling out any contraindication and a screening ECG. Other treatment modalities used on case-to-case basis were prophylactic or therapeutic doses of LMWH (n=24; 14.9%), systemic corticosteroid (n=23; 14.3%), IV Antibiotics (n=32; 19.9%), oral Favipiravir (n=16; 9.9%), IV Remdesivir (n=10; 6.2%), oxygen supplementation (n=14; 8.7%) and ventilatory support (n=5; 3.1%).

The 25 patients with moderate disease included 16 patients who had persistent fever of > 3 days of admission with raised inflammatory markers requiring IV Antibiotics along with systemic glucocorticoids and prophylactic low molecular weight heparin. Out of these 16 patients, 14 patients recovered without any further intervention, however 02 patients had persistent fever of > 3 days even after starting above therapeutics for which oral Favipiravir was added. The other 9 patients progressed to hypoxemia with respiratory rate in the range of 24-30 and SpO2 in the range of 90-94% and required supplementary oxygen support through nasal cannula or face mask. These patients were also given Favipiravir along with IV Antibiotics, systemic corticosteroids and LMWH. Of these 9 patients, 05 progressed to requirement of oxygen through non-rebreathing mask (NRBM) for maintaining target SpO2 in which Favipiravir was changed to Remdesivir.

The 5patients in severe disease progressed to have respiratory distress and severe hypoxemia with RR > 30 and SpO2 < 90% even with above therapeutic modality, were changed over to IV Remdesivir along with systemic corticosteroids, therapeutic doses of LMWH and ventilatory support. All 5 patients were initially placed on non-invasive ventilatory (NIV) support. Three of these patients recovered on NIV support and subsequently discharged, however 02 patients required mechanical ventilation because of not maintaining target SpO2 who subsequently succumbed after 17 days of total illness days each. These were a 50 yrs old female with Diabetes, Hypertension, obesity & hypothyroidism, and a 61 yrs old male with Diabetes, Hypertension, Coronary Artery Disease & COPD.

The data on laboratory parameters of patients on the day of admission are as shown in Table 3. On admission, Leucopenia was observed in 32 (19.8%), and leucocytosis in 04 (2.5%) patients. Lymphocytopenia was observed in 55 (34.2%) patients with Neutrophil to Lymphocyte (N/L) ratio of > 3 in 29 (18.0%) patients.28 (17.4%) patients had mild transaminitis and only 02 (1.2%) had AKI which subsequently recovered with supportive management. Combined N/L ratio > 3 and CRP positivity on the day of admission was seen in 13 (8.0%) patients all of whom later progressed to moderate or severe disease.

4. Discussion

This study, to our knowledge, is the largest hospitalised COVID-19case series report at a peripheral hospital of Indian Armed Forces. The earlier studies have only reported a series of 08 cases (18) and of 03 patients with atypical presentation in COVID-19 (19) . This study attempts to evolve certain findings to identify patients of COVID-19 at-risk of progressing to moderate or severe disease to reduce the morbidity and mortality in them.

The median (IQR) age of our patients was 30 (23-44 years) and there was male preponderance with male to female ratio of 8.47 which significantly varies when compared to previous study from India (20, 15, 21) and rest of the world (22–24) , which is possibly due to predominance of younger unmarried male work force in Armed Forces who stay in barracks with increased risk of transmission of contagious diseases between them. There was significant association of increased risk of moderate or severe disease with increasing age (p value < 0.001) specially in age > 40 years (Sensitivity 60%, Specificity of 71.7%, PPV of 32.7% and NPV of 88.7%) which is comparable to studies by Wang et al and Gallo Marine et al (25, 26) .

There was no significant association between the gender and severity of the disease (p value 0.09). However, chi-square test of study population gender proportion to the estimated gender proportion (Males 51.5% and Females 48.5%) in general population of India as per CENSUS 2011 (27) showed a significant association of occurrence of disease in male population (p value <0.001) which is a similar to the observation made in the study by Chen et al at Wuhan, China (28) . This finding can be more pertinent to Indian families in which the female counterparts takes on the challenging role of housemaker and child care, with further reduction of their outdoor activities due to lockdown in India which was imposed on 25 Mar 2020 and is still in force with certain relaxations.

In our study, maximum number of patients had B+ type of blood group followed by O+. However, There was also no significant correlation of occurrence of disease in any particular blood group when compared to the prevalence of various blood group in general population of India (29, 30) (p value 0.346). This finding differs from the studies with the studies by Wu et al, Zeng et al and Zhao et al (31–33) . This difference in observation is seen because all of these studies have done the analysis taking the proportion of various blood group in their patient population only rather than comparing with the prevalence of various blood group type in general population of their country. Also, there was no significant association of increased severity of disease with any blood group (p value 0.83) or Rh type (p value 0.84) which is similar to the studies on similar subject (31–33) . We found that presence of a pre-existing illness specially in patients with more than one co-morbidities had higher risk of progression to moderate or severe disease (p value 0.046) which is similar to the findings in study by Dosi et al and Fang et al (34, 35) .

The clinical outcome and the severity spectrum in our study population showed that our patients predominantly had mild disease (81.4%) followed by Moderate (15.5%) and Severe Disease (3.1%) which is comparable to the proportions reported in symptomatic patients in Indian studies (20, 21, 36) and studies from China (23, 37) . There were 02 deaths from the severe category with case fatality rate of 1.2% which is significantly lower than few of the studies (15, 38) but comparable to studies by Mohan et al and Guan et al (20, 23) . Both of these patients had multiple co-morbidities.

The median (IQR) duration of illness and hospitalisation in all cases was 06 (3.5-8.5 days) and 09 (5-13 days) respectively which is similar to the findings in study by Kayina et al (39) . These durations were higher in patients with higher severity (p value <0.001). In moderate and severe disease category, 28 patients had median (IQR) duration of worsening of 9 (7-11 days) from the onset of illness which is comparable to the duration of worsening in the study by Huang et al (38) .

Fever followed by body ache, headache and cough were the most common presenting symptoms in our patients which was also the trend seen in various studies from China (40) , New York (24) and India (34) . Due to the lack of definitive evidence based treatment at the start of the pandemic, we followed the clinical management guidelines formulated and updated time to time by MoHFW, Govt of India (6) . All patients were given symptomatic treatment with paracetamol, levo-cetrizine, diphenhydramine on case-to-case basis along with off-label use of vitamin C, zinc and vitamin D. Only Hydroxychloroquine, Favipiravir and Remdesivir have shownsome benefits as antivirals in mild, mild to moderate (41) and moderate to severe cases (42) of COVID-19 respectively. However, these have only been granted emergency use authorisation by DCGI for use in India. Hence, HCQ, Favipiravir and Remdesivir were used in 33, 16 and 10 patients respectively on case-to-case basis only as an 'off-label' use after obtaining proper written consent from the patients and not as a blanket treatment. Systemic corticosteroids and LMWH were predominantly used in patients with moderate and severe disease. IV Antibiotics (n=36) were given for 7 days in cases of persistent fever of > 3 days and patients requiring IV Corticosteroids, LMWH and Oxygen support to prevent secondary infections.

Leucocytosis with neutrophilia and lymphopenia on the day of admission showed significant correlation with high risk of progression to moderate or severe disease. However, if these are combined in to one as neutrophil to lymphocyte (N/L) ratio then N/L ratio of > 3showed high value in predicting if a patient is at risk of progressing to higher end in severity spectrum (p value <0.001). These findings of Leucocytosis with Neutrophilia and lymphopenia are in congruence with other studies from India (15, 39) . The other laboratory parameters which showed significant correlation to higher severity in the disease were raised ESR (p value < 0.001), and raised renal functions (p value 0.002) which was also seen in studies by Chen et al and Cao et al (28, 43) . High random blood sugar at the time of admission (p value < 0.001) was observed in moderate to severe cases which was confirmed by regular blood sugar monitoring. This was also seen in the metanalysis done by Chen et al (44) . However, it requires further research to ascertain that whether this finding is due to COVID related increased insulin resistance or stress induced production of counter-regulatory hormones. CRP was positive in 25 patients and showed significant correlation with moderate and severe disease (p value < 0.001) which is similar to the findings in study by Pourbagheri-Sigaroodi et al (45) . On combining N/L ratio > 3 and CRP positive findings, we found that it can predict the progression of disease to moderate or severe with specificity and PPV of 100% (Table 4) which can be very useful in peripheral hospitals like ours where the facilities for investigations like quantitative CRP, D-Dimer, Ferritin, procalcitonin and IL-6 are not available. However, D-Dimer, Ferritin, Procalcitonin and IL-6 were done only in patients who progressed to moderate or severe disease on case-to-case basis from private laboratories. Hence, comparative analysis of these investigations between mild and moderate/severe cases was not done. The backward conditional multivariate logistic regression analysis of categorical variables (with p value < 0.1) showed patients presenting with bodyache, diarrhoea or dyspnoea at the time of admission and presence ofone or more comorbidities, also to be independent predictors of moderate/severe COVID-19 disease (Table 5).

5. Conclusion

In this single centre study of 161 COVID-19 patients admitted at a peripheral hospital we found that almost 20% of patients may progress to moderate or severe COVID-19 disease. Hence, it is important to identify various clinico-demographic and pathological markers to predict this progression early so as to impart timely intervention to reduce the morbidity and mortality due to COVID-19. This study shows that patients with age >40 years, presenting symptoms of body ache, diarrhoea or dyspnoea, presence of one or more comorbidities, and laboratory parameters showing raised ESR, raised renal function and high random blood sugar at the time of admission had propensity to progress in severity spectrum of the disease. N/L ratio > 3 along with CRP positivity at presentation hashigh predictive values in identifying patients at risk of progression of disease. The limitation in our study was the small number of sample size and the restriction of providing services to only entitled clientele population of Armed Forces. Hence, further research is required in general population with larger sample size to authenticate above findings of our study.

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Conflict of Interest

There is no conflict of interest.

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