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Comorbidities and Clinical Outcomes of Patients with COVID 19 in a Tertiary Care Center at Goa: A Prospective Observational Study

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Abstract

Background: It is believed that COVID-19, in those with comorbidities, has an increasingly rapid and severe progression, often resulting in mortality. This study explores various comorbid conditions, disease severity, and clinical outcomes in patients infected with COVID-19.

Methods: This is a prospective observational study. Clinical data of COVID-19 patients admitted at Goa Medical College between November 23, 2020, to December 23, 2020, are summarized and analyzed using Google forms, spreadsheets, and R programming language.

Results: A total of 100 patient data was collected, including 5% mild, 61% moderate, and 34% severe cases. Fever (83%) was the most common symptom, followed by dry cough (83%), dyspnoea (79%), and fatigue (32%). The most common comorbidities identified were diabetes (66%), hypertension (57%), and cardiovascular and cerebrovascular conditions (27%). Clinical outcome in patients was pneumonia (84%), ARDS (40%), bronchiolitis (10%), and shock (3%).

Conclusion: Our study estimated that older men with underlying hypertension, diabetes, cardiovascular, and cerebrovascular conditions are at higher risk for severe clinical form. Fever, cough, and dyspnea were the most common signs on admission. The laboratory parameters showed a significant increase in CRP, ferritin, LDH, procalcitonin, ESR, and d-dimer in the case of SARS-CoV-2 infection.

Keywords: COVID-19, Comorbidity, Non-invasive Ventilation, Diabetes Mellitus, Hypertension.

Introduction

The COVID-19 outbreak in December 20191 has hit more than 200 countries with over 62.8 crore cases and 65.8 lakhs deaths globally, as of October 2022 [2, 3]. The clinical manifestations range from a common cold

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to more severe diseases like bronchitis, pneumonia, severe acute respiratory distress syndrome (ARDS), multi-organ failure, and even death. It is believed that COVID-19, in those with underlying health conditions or comorbidities, has an increasingly rapid and severe progression, often resulting in mortality. Older adults and people of any age who have underlying medical conditions, like hypertension, and diabetes, have shown worse prognosis. Diabetic patients have increased morbidity and mortality rates and have been linked to more hospitalization and intensive care unit (ICU) admissions4. Also, the clinically vulnerable group includes patients with chronic kidney disease, chronic liver disease, chronic neurological conditions, obesity, and pregnancy who are at high risk[5, 6]. Patients with comorbidities should take all necessary precautions to avoid getting infected with SARS-CoV-2, as they usually have the worst prognosis. This paper examined the comorbid conditions, the progression of the disease, and mortality rates in patients of all ages infected with the ongoing COVID-19 disease at Goa Medical College.

Objectives

- Estimate the association between comorbidities and other risk factors to the severity of COVID-19 infection.
- Study results will help develop targeted prevention and control strategies to combat COVID-19 in Goa state.

Materials and methods

Participants

All participants were laboratory-confirmed cases of SARS-CoV-2 infection and got admitted to Goa Medical College Hospital. The analysis was done for three months (from November 23, 2020, to December 23, 2020). The first 100 patients who agreed to participate in the study were selected.

Case definition

The hospitalized patients were divided into three groups according to severity based on the Ministry of Health and Family Welfare (MOHFW) National Clinical Management Protocol COVID-19.[7,8] The first group, ''Mild,'' were cases with mild clinical forms. The definition of "Moderate" were cases with moderate clinical conditions (Pneumonia with no signs of severe disease, RR >24/min, SpO2 <94% on room air). Definition for severe—patients with clinical signs of pneumonia plus one of the following, RR >30 breaths/min, severe respiratory distress, or SpO2 < 90% on room air.

Inclusion criteria

(1) people older than 18 years, (2) laboratory-confirmed infection with SARS- CoV-2, and (3) patients with clinical presentation of COVID-19.

Ethics statement

The study was performed by the principles of the Declaration of Helsinki. The Institutional Ethics Committee of Goa Medical College, Goa, approved this study.

Statistical analysis: was performed by Google Sheets and R program. A p-value < 0.05 was considered statistically significant. Shapiro-Wilk test was done for each lab variable. We did Welch Two Sample t-test for normal distribution and Wilcoxon rank-sum test with continuity correction for others. We performed generalized linear model (GLM) regression analysis to infer causal relationships between covid 19 disease severity (independent variable) and lab values (dependent variables). Association between comorbidities and disease severity SARS-CoV-2 positive cases were compared by Chi-square test.

Results

Demographic characteristics

One hundred patients with laboratory-confirmed SARS-CoV-2 infection were enrolled in the study for the analyzed period. 48% of all patients belonged to 50–69 years. The female sex dominated among analyzed COVID-19 patients (sex ratio: male/female = 44/66). The mean length of hospital stay was 10.42 days. The exposure history noted 20% of familiar/cluster cases and 79% unknown. Only 12% of participants have a job with more interaction with people. Based on severity, 5 mild, 61 moderate, and 34 patients had severe disease.

Clinical symptoms

The leading clinical signs on hospital admission were fever, cough, and dyspnoea (Figure 1). Patients rarely mentioned gastrointestinal disorders. On hospital admission, 83% of patients had body temperatures above 100.4 degrees Fahrenheit. On admission, oxygen saturation below 93% was found in 39.9% of patients using a pulse oximeter.

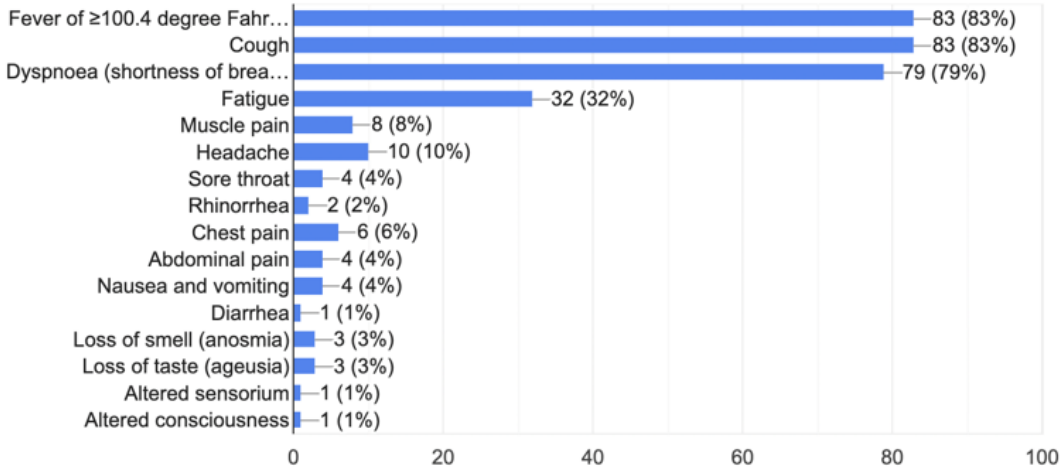

Figure 1: Clinical symptoms on hospital admission

Laboratory results

Elevation of acute phase reactants was observed (CRP, ESR, D-dimer, ferritin, LDH, and procalcitonin). We combined mild covid 19 disease patients with moderate disease category as patients with mild disease were few in number since it was a hospital-based study. Most of the admitted patients were with moderate or severe diseases. We found that acute-phase reactants showed significant differences between severe and mild-moderated disease groups (p-value < 0.05). Urea and lymphocyte also showed a significant increase in groups with severe covid 19 diseases. (Table 1).

Table 1: Laboratory results of all study participants, and comparison between severe and mild to moderate groups.

Parameter (Unit)	Reference range	Total (n=100) Mean (SD)	Severe (n=100) Mean (SD)	Mild to moderate (n=100) Mean (SD)	P value (Welch Two Sample t-test or Wilcoxon rank-sum test with continuity correction based on Shapiro-Wilk test)
Urea (mg/dL)	5-20	52.01 (43.36)	63.15 (50.43)	46 (38.12)	W = 752.5, p-value = 0.02
Procalcitonin (ng/mL)	<0.1	6.03 (22.11)	10.36 (29.81)	3.45 (15.63)	W = 727.5, p-value = 0.05
Creatinine kinase (U/L)	22-198	10.08 (16.47)	2.6 (0.548)	17.56 (21.68)	W = 16, p-value = 0.52
ESR (mm/hr)	0-22 (M), 0-29 (F)	34.28 (13.72)	46.71 (12.019)	28 (23-32)	W = 242.5, p-value < 0.001
CRP (mg/L)	<10	39.81 (12.81)	47.38 (9.40)	35.91 (12.63)	t = -5.1221, df = 85.434, p-value < 0.001
LDH (U/L)	140-280	662.04 (255.48)	808.35 (205.76)	586.67 (246.88)	W = 443.5, p-value = < 0.001
D-dimer (ng/mL)	0-198	4095.01 (3141.48)	6261.03 (2831.48)	2979.19 (2691.18)	W = 431, p-value = < 0.001
Ferritin (ng/mL)	10–300	2450.72 (2065.96)	3256.50 (2025.33)	2035.63 (1975.78)	W = 614, p-value = < 0.001

On comparative analysis, lab results show significant variation in mild, moderate, and severe disease (Figure 2). It is elevated respective of the clinical severity. We also found a similar observation in our predictive analysis of various laboratory indicators and the outcome variable as disease severity. (Table 2). We used a generalized linear model (GLM) for regression analysis. We found that D-dimer, Ferritin, ESR, and lymphocyte values predict the Covid 19 disease severity.

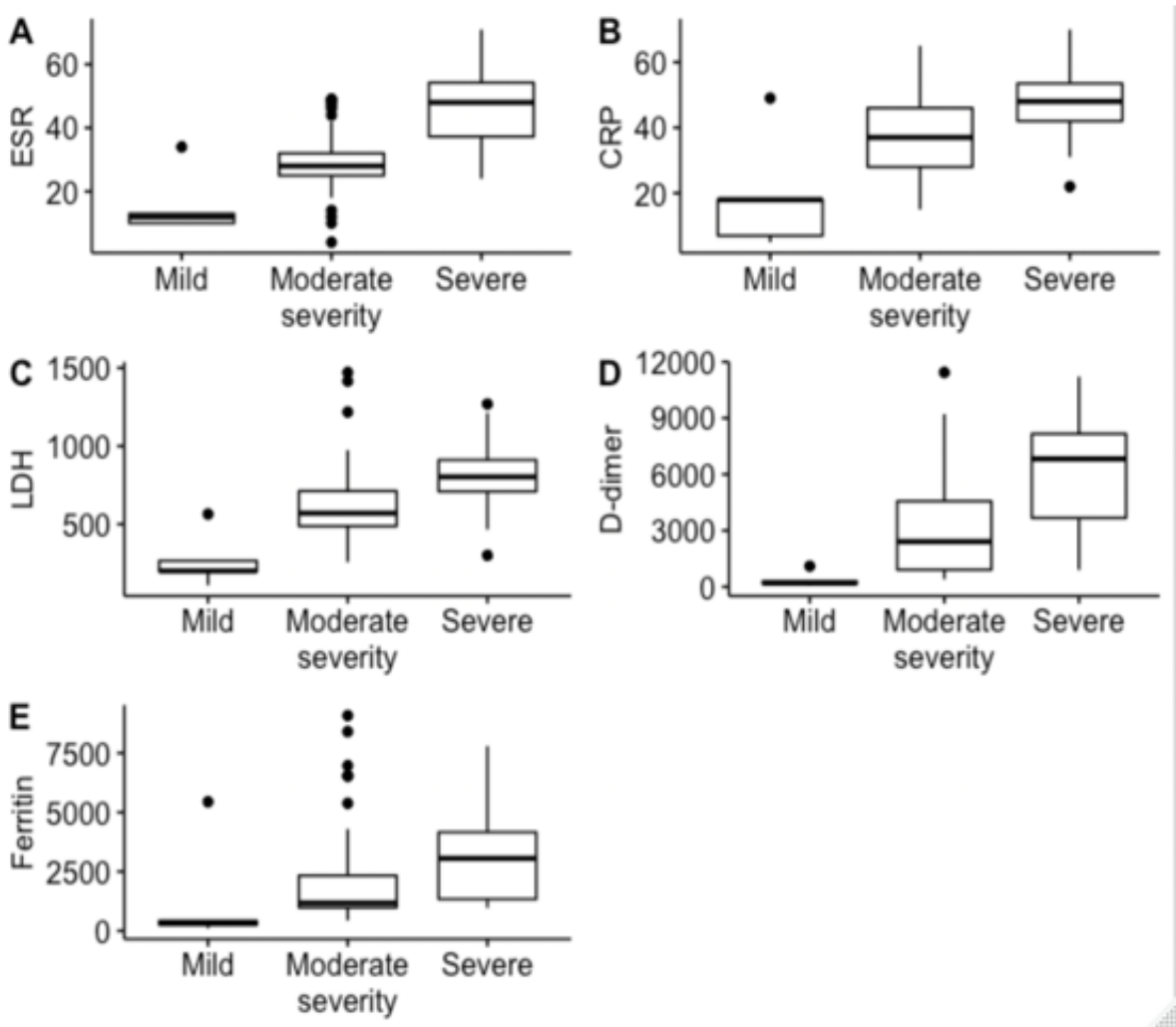

Figure 2: Boxplots of selected laboratory indicators vs. disease severity

Table 2: Logistic Regression analysis showing the causal relationship between the severity of SARS-CoV-2 infection and laboratory parameters.

	Estimate	Std. Error	z-value	Pr(>|z|)
Lymphocyte	-0.102	0.031	-3.264	0.001 **
ESR	0.076	0.029	2.577	0.009 **
CRP	-0.022	0.030	-0.732	0.46
LDH	-0.002	0.000	-1.098	0.27
`D-dimer`	0.000	0.000	2.766	0.006 **
Ferritin	-0.000	0.000	-1.993	0.046 *
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Imaging procedures

On admission, a chest x-ray was performed in 64% of patients. Lung infiltrates were observed in 61% and were absent in 3 %. Chest-computed tomography (CT) was performed in 39 % of patients during the hospital stay. Chest CT showed ground-glass opacity of 36 %.

Therapy

All patients were treated in hospital isolation. The following antiviral treatment was given (figure 3)

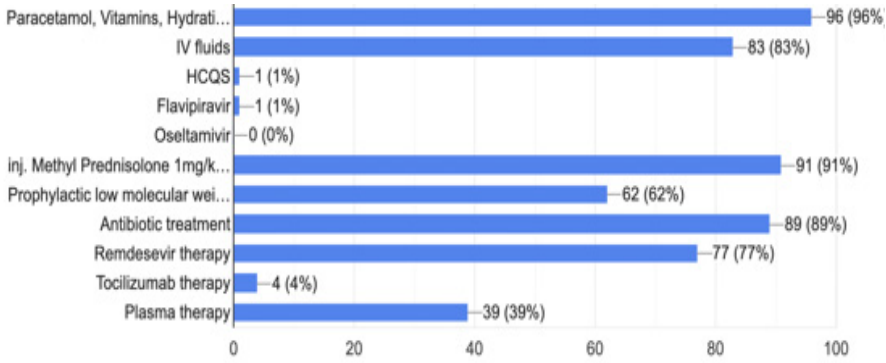

Figure 3: The treatment has given

Supportive measures

Out of 100 patients, 85 had supportive measures like oxygen therapy (38%), non-invasive ventilation (51%), and invasive ventilation (4%). Intensive Care Unit admission was needed in 38% and underwent dialysis in 4% of patients.

Association with comorbidities

The most common comorbidities identified were diabetes (66%), hypertension (57%), and cardiovascular and cerebrovascular conditions (27%). The less common comorbidities were respiratory illnesses (7%), renal disorders (11%), malignancy (3%), and liver disorders (1%).

Patients with COVID-19 disease with comorbidities such as hypertension, diabetes mellitus, and cardiovascular and cerebrovascular conditions are more likely to develop a more severe course and progression of the disease ($p < 0.05$). Malignancy, renal disorders, and respiratory illness show more minor associations between COVID-19 disease severity in our study ($p > 0.05$).

Clinical outcomes

Discharged with improvement was 96% of patients, and lethal outcomes 4%. Nineteen patients passed through the intensive care unit (five patients were intubated). All dead patients had underlying comorbidity. Discharge from the hospital was performed after a negative RT-PCR test in case of severe COVID infection and/or clinical symptoms of improvement in case of mild or moderate disease, as per guidelines.[9]

Discussion

In the current study, the mean age of all 100 patients was 52.9 years, and 63% prevalence of male sex. Zheng et al. [9] found a mean age of 49.4 years, and 51.5% of patients were men in their hospital study. Liu et al.[6] reported 57 years as the mean age and 55.5% female. Li et al. [10] found a mean age of 50 years, and 53.3% were male patients. Wang et al.[11] reported 49.4 years as the mean age of critical patients and 56.8% were female patients. In their retrospective study, Tian et al.[12] found the mean age of 61.4 years of severe patients, and 51.5% (135/262) of all patients were female. A study in India by Ravi et al. reported median age of 49 years, 58.66% of males. We supposed that demographic characteristics and national features influence these slight differences.

The present study showed significant morbidity with severe form in older age groups, male gender, and comorbidities such as hypertension, heart diseases, malignancy, and kidney disorders. It is similar to data from other authors (Colaneri et al. 2020[13], Petrilli et al. 2020[14], Wang et al.[15], Zheng et al., [9]).

Similar to our study, fever, cough, and dyspnea were the most common signs of admission in Italian patients (Colaneri et al.[13]). Chinese patients noted fever, cough, and fatigue (Liu et al.[6], Wang et al.[15], Zhang et al.[16], Zheng et al.[9]). Zheng et al.[17] reported the following clinical signs-fever (75.8%; 122/161), cough (62.7%; 101/161), fatigue (39.8%; 64/161), and dyspnea (14.3%; 23/161). Our research assessed the presentation of dyspnea/chest tightness as the factor for severe clinical form. Dyspnea was a risk factor for aggravation of illness by Wang et al.[15]

Acute phase reactants like CRP, ESR, D-dimer, ferritin, LDH, and procalcitonin showed a significant difference between severe and mild-moderate disease groups (p-value < 0.05). The ferritin is abnormal with the severity of covid-19 disease, but its value remains to be explored.[18] Even though we classified the patients as mild, moderate, and severe groups based on the clinical presentation during admission according to the Ministry of Health and Family Welfare (MOHFW) National Clinical Management Protocol COVID-19 [7,8], later the lab results also supported the same.

Zhang et al.[16] estimated the significant meaning of elevated CRP (increased—91.9%, 125/136 of patients; p < 0.001) and d-dimer (increased—43.2%, 35/81 of patients; p < 0.001), lower lymphocyte percentage in severe cases (12.7%) than in non-severe cases (20.0%). Colaneri et al.[13] found significantly higher odds of severe disease associated with an increased level of LDH (OR = 1.090; 95% CI: 1.022–1.163; p = 0.008). Petrilli et al.[14] estimated association with critical illness and elevation of CRP (>200 mg/L; hazard ratio = 5.07; p < 0.001), and d-dimer (>2500 lg/L; hazard ratio = 2.16; p < 0.001).

Our therapy was based on worldwide recommendations, national protocol, and researchers' experience.[7] No significant data were found on antiviral treatment in the current survey. In the present study, the estimated mortality rate (4%) was higher than at the national level—0.014% (146,756/10,123,778) up to date December 24, 2020[19]. A study by Khedar et.al in Jaipur, India, showed 98 (11.5%) higher mortality in hospitalized patients during the first wave.[20] Our explanation for this statement is the individual approach to each patient. Wang et al.[15] reported the same mortality (4.3%). The Italian experience of the first week in a European outbreak estimated a 4.5% mortality rate among 44 hospitalized patients in a single hospital in Pavia, Italy (Colaneri et al.[13]). Many factors influenced this indicator, so various reasons influence the values. Therefore, in our opinion, it is appropriate to search for prognostic factors like comorbidity for a severe clinical form to take timely measures.

Limitations

It was single-center research; a short follow-up, and few participants. A larger sample size may give more insight into the relationship between these lab values and the severity of COVID-19 infection. Despite these limitations, this is the first study for Goa hospitalized patients with COVID-19, giving valid scientific evidence into this infection.

Conclusion

Our study estimated that older men with underlying hypertension, diabetes mellitus, and cardiovascular and cerebrovascular conditions are at higher risk for severe clinical form. Malignancy, renal disorders, and respiratory illness show more minor associations between COVID-19 disease severity. Fever, cough, and dyspnea were the most common signs on admission. The laboratory parameters showed a significant increase in CRP, ferritin, LDH, ESR, d-dimer, and procalcitonin in the case of SARS-CoV-2 infection. All these inflammatory markers showed a significant increase in disease severity. Our therapy was based on the clinical management protocol of MOHFW. In the present study, the estimated mortality rate was higher than at the national level. These study findings support the current knowledge on COVID-19, that comorbidities have a significant relation with the severity of covid 19 infection.

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Conflict of interest: no

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