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ORIGINAL RESEARCH

Clinical, Laboratory and Radiological Parameters of Covid 19 Pneumonia: A Single-Centered Retrospective Observational Study in Pune, India

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Abstract

Background: The severe acute respiratory syndrome coronavirus called the novel coronavirus caused the pandemic coronavirus disease 19 (COVID-19). All over the world, SARS‑CoV‑2 pneumonia is causing significant short‑term morbidity and mortality, but the medium‑term impact on lung function and quality of life of affected patients is still unknown.

Aims: To assess clinical, laboratory, and radiological parameters of COVID-19 Patients and to correlate radiological findings and disease severity among patients.

Methodology: In this retrospective observational study a total of 630 patients with radiologically confirmed pneumonia and COVID-19 RT PCR positive were included from a tertiary care centre in Pune, Maharashtra, following their voluntary informed consent. Patients underwent clinical, laboratory, and radiological investigations.

Results: It was observed that the majority 174 (27.6%) were in the age group of 31 to 40 years and male predominance was observed compared to female. The majority of the patients 314 (49.8%) had mild, 232 (36.8%) were moderate and 84 (13.3%) had severe illness as per CT scores (HRCT Chest score). Mean BSL levels were 181 ± 81.44, mean pulse rate was 94.03 ± 14.93 bpm, mean respiratory rate was 22.84 ± 3.71cpm, systolic blood pressure was 129.09 ± 13.18 mmHg, diastolic blood pressure was 82.80 ± 9.67mmHg and mean temperature was 98.56 ± 1.67 °F. The mean ferritin levels were 181 ± 81.44, the mean LDH level was 94.03 ± 14.93, mean HbA1C was 7.45 ± 1.68. The mean NLR was 5.51 ± 2.41, the mean WBC count was 7238.38 ± 4942.23 and the mean hematocrit was 39.69 ± 4.80. The mean D dimer level was 402.29 ± 424.70, median levels were 260 (170-450). 503 (79.8%) had CRP levels more than 5 and 127 (20.2%) had levels less than 5. The mean duration of hospital stay was 9.18 days ± 4.34 days. Majority 570 (90.5%) had fever, 493 (78.3%) had

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cough, 286 (45.4%) had breathlessness, 66 (10.5%) had sore throat. Other symptoms include vomiting, and loose motion in 17 (2.7%). Among 630 subjects included in the present study, the majority 584 (92.7%) have recovered/were discharged from the hospital and 46 (7.3%) succumbed to the illness. The mean SGOT and SGPT levels were 44.86± 31.29 and 43.60 ± 31.25 respectively. Mean serum creatinine and BUN levels were 0.87± 0.80 and 13.96 ± 9.46 respectively. The mean values of pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate and temperature showed an increasing trend across the grades of severity.

Conclusion: We concluded that age, gender, blood sugar level, blood pressure, clinical symptoms, comorbidities, inflammatory biomarkers and CT severity score were independently associated with the severity and mortality based on our findings.

Keywords: COVID-19, Clinical features, Radiological features, Laboratory findings

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) is a novel coronavirus that caused the pandemic coronavirus disease 19 (COVID-19). In disease pathogenesis and clinical manifestations, the host immune response to SARS-CoV-2 appears to play a critical role.

"Patients may be asymptomatic, present with mild symptoms like fever and cough, or may present with severe pneumonia associated with acute respiratory failure. The SARS-CoV-2 virus primarily affects the respiratory system, although other organ systems are also involved. It is now widely recognized that respiratory symptoms of COVID-19 are extremely heterogeneous, ranging from minimal symptoms to significant hypoxia with acute respiratory distress syndrome (ARDS)".[1]

"A high percentage of patients have pre-existing comorbidities including hypertension (HTN), Type 2 Diabetes mellitus (T2DM), obesity, chronic kidney disease (CKD), cardiovascular disease (CVD), old age, and dyslipidemia. The clinical spectrum of SARS-CoV-2 pneumonia ranges from mild to critically ill cases. Previous studies have described the general epidemiological findings, clinical presentation, and clinical outcomes of patients with SARS-CoV-2 pneumonia". [2,3]

In this study, we investigated the radiological parameters of confirmed SARS-CoV-2 pneumonia. For the early identification of individuals who are at risk of becoming critically ill and who are most likely to benefit from intensive care treatment, the baseline SARS-CoV-2-associated morbidity and mortality data from this study will be of considerable value.

Besides, most of the COVID-19 data were obtained from hospitalized patients and there are few studies from outpatient clinics. How to address persistent complications is still unknown, but primary care can follow up on them with the support of specialist assessment if necessary.

Methods

This retrospective observational study was conducted from 01 July 2020 to 30 June 2021at the Department of Medicine, Ruby Hall Clinic Hinjawadi Hospital, Pune, Maharashtra. The present study was initiated after getting approval from the Scientific and Ethical Committee of the Institution. All the study patients or caretakers were informed about the study and voluntary informed written consent was taken from the participants who were included in the study. We identified 630 patients who were hospitalised with radiologically confirmed pneumonia and COVID-19 RT PCR positive with above18 years of age and included in the study. Pregnant subjects were not included in the study. Data analyses included clinical data, laboratory parameters, radiological data and the outcome of the patient.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

Statistical Methods

Data was entered in the excel spreadsheet. Statistical Package for the Social Science (SPSS) version 24.0 was used for statistical analysis. Descriptive statistical measures like percentage, mean and standard deviation were applied. Inferential statistical tests like the chi-square test and ANOVA were applied. Association and differences were interpreted as statistically significant at $p<0.05$.

Results

Radiology - HRCT evidence of Pneumonia

In this study, it was observed that among 630 subjects, the majority of the patients 314 (49.8%) had mild, 232 (36.8%) moderate and 84 (13.3%) had severe illnesses as per CT scores (HRCT Chest score). Mortality was more common among subjects with severe grade 26 (31.0%) and least with mild grade 6 (1.9%). The association between severity grade and mortality was found to be statistically significant. (Table 1)

Severity	Recovered	Death	Total	Chi	p
Mild	308 (98.1)	6 (1.9)	314 (49.8)	83.45	0.001
Moderate	218 (94.0)	14 (6.0)	232 (36.8)		
Severe	58 (69.0)	26 (31.0)	84 (13.3)		
Total	584 (92.7)	46 (7.3)	630		

Table 1: Relationship between severity and mortality square test

Age and sex distribution

Among 630 subjects included in the study, majority 174 (27.6%) were in the age group of 31 to 40 years. At least, 58 (9.2%) were less than 30 years of age. Among 630 subjects included in the study, majority of 445 (70.6%) were males and 185 (29.4%) were females.

BSL random, Pulse, BP and Temperature on admission

Mean BSL levels were 181 ± 81.44, mean pulse rate was 94.03 ± 14.93 bpm, mean respiratory rate was 22.84 ± 3.71cpm; systolic blood pressure was 129.09 ± 13.18 mmHg, diastolic blood pressure was 82.80 ± 9.67mmHg and mean temperature was 98.56 ± 1.67 °F. (Table 2)

BSL	Frequency	Percent
Normal	435	69.0
Abnormal	195	31.0
Total	630	100.0
Pulse rate	**Frequency**	**Percent**
Normal	445	70.6
Bradycardia	5	0.8
Tachycardia	180	28.6
Total	630	100.0
SBP	**Frequency**	**Percent**
Normal	416	66.0
Abnormal	214	34.0
Total	630	100.0
DBP	**Frequency**	**Percent**
Normal	409	64.9
Abnormal	221	35.1
Total	630	100.0
Temperature	**Frequency**	**Percent**

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

Normal	489	77.6
Abnormal	141	22.4
Total	630	100.0
Ferritin	**Frequency**	**Percent**
Normal	317	50.3
Abnormal	313	49.7
Total	630	100.0
CRP	**Frequency**	**Percent**
<5	127	20.2
>5	503	79.8
Total	630	100.0
D Dimer	**Frequency**	**Percent**
Normal	487	77.3
Abnormal	143	22.7
Total	630	100.0

Table 2: Distribution of study subjects based on vital parameters

Among 630 subjects included in the present study, the majority 405 (64.3%) had SpO_2 levels of more than 94% at the time of admission, and 282 (44.8%) were either newly diagnosed or had previous cases of diabetes mellitus. The majority of the patients 405 (64.3%) had symptoms onset between 8 and 14 days and 184 (29.2%) had less than 7 days. The majority of 209 (33.2%) had hypertension, 50 (7.9%) had IHD, 9 (1.5%) had CKD, and 1% of subjects had tuberculosis, COPD, hypothyroidism and CVA. Among 630 subjects included in the study, mean ferritin levels were 181 ± 81.44, mean LDH level was 94.03 ± 14.93, and mean HbA1C was 7.45 ± 1.68.

The mean NLR (Neutrophil-Lymphocyte ratio) was 5.51 ± 2.41, mean WBC count was 7238.38 ± 4942.23 and mean hematocrit was 39.69 ± 4.80. The mean D dimer level was 402.29 ± 424.70, median levels were 260 (170-450). 503 (79.8%) had CRP levels more than 5 and 127 (20.2%) had levels less than 5. The mean duration of hospital stay was 9.18 days ± 4.34 days. The majority of the patients 428 (67.8%) had a duration of stay in the hospital between 6 and 10 days followed by 112 (17.8%) who stayed between 11 and 15 days. 300 (47.62%) patients received oxygen through nasal prongs, 158 (25.08%) through VM vent, 120 (19.05%) through NHF, 68 (10.79%) through BIPAP. Among 630 subjects included in the present study, the majority of 588 (93.3%) received nebulisation.

Outcome

Among 630 subjects included in the present study, the majority 584 (92.7%) have recovered/were discharged from the hospital and 46 (7.3%) succumbed to the illness. The mean IL 6 levels were 104.37 ± 94.62. The mean SGOT and SGPT levels were 44.86± 31.29 and 43.60 ± 31.25 respectively. Mean serum creatinine and BUN levels were 0.87± 0.80 and 13.96 ± 9.46 respectively. Mean sodium and potassium levels were 139.93± 4.60 and 4.17 ± 0.45 respectively. Majority 570 (90.5%) had fever, 493 (78.3%) had cough, 286 (45.4%) had breathlessness, 66 (10.5%) had sore throat. Other symptoms included vomiting and loose motion in 17 (2.7%).

As the age increased the severity of the disease also increased and the difference in mean age across the grades of severity was found to be statistically significant. (Table 3)

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

Severity	Mean	SD	F	p
Mild	46.31	14.373	6.025	0.003
Moderate	49.66	14.600		
Severe	51.64	16.337		
Table 3: Relationship between age and severity				

The mean values of pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate and temperature showed an increasing trend across the grades of severity. The difference in mean SBP, RR and temperature across the stages was found to be statistically significant. (Table 4)

Parameter	Mild	Moderate	Severe	F	p
PR	93.74 ±14.21	93.75 ±15.46	95.92 ±15.98	0.770	0.453
SBP	131.96 ±15.44	134.53 ±16.12	136.15 ±17.79	3.082	0.047
DBP	82.87 ±9.88	82.66 ± 9.28	83.94 ±12.66	0.513	0.599
RR	21.51 ±2.49	23.04 ±3.36	27.19 ±4.85	105.02	0.001
Temperature	98.72 ±1.55	98.50 ±1.92	98.15 ±1.28	4.205	0.015
Table 4: Relationship between vital parameters and severity					

The mean values of ferritin, LDH, BSL and IL6 showed an increasing trend across the grades of severity and the stages were found to be statistically significant. The mean values of BUN and creatinine; sodium and potassium; SGOT and SGPT showed an increasing trend across the grades of severity. The difference in mean SGPT levels across the grades of severity was found to be statistically significant. (Table 5)

Parameters	Mild	Moderate	Severe	F	p
FERRITIN	332.71 ± 320.87	506.60 ±427.97	691.46 ±514.24	30.775	0.001
LDH	256.55 ± 87.01	325.24 ± 120.99	588.10 ± 400.64	116.50	0.001
BSL	167.60 ± 71.44	191.83 ± 87.32	203.18 ± 91.91	0.694	0.500
IL6	147.06 ±61.83	324.62 ±102.93	437.63 ±203.55	6.542	0.040
Parameters	**Mild**	**Moderate**	**Severe**	**F**	p
BUN	13.33 ± 8.53	14.31 ± 10.63	15.41 ± 9.25	1.812	0.164
Creatinine	0.83 ±0.73	0.90 ± 0.95	0.93 ± 0.55	3.244	0.197
Parameter	Mild	Moderate	Severe	F	p
Sodium	140.18 ± 4.24	139.71 ± 5.09	139.61 ± 4.54	0.681	0.712
Potassium	4.17 ± 0.39	4.19 ± 0.50	4.10 ± 0.52	1.878	0.391
Parameter	Mild	Moderate	Severe	F	p
SGOT	45.50 ± 32.77	43.42 ± 28.92	46.52 ± 32.09	0.799	0.671
SGPT	46.18 ± 32.77	40.65 ± 29.49	42.09 ± 29.58	6.336	0.042
Table 5: Relationship between severity and various study parameters of renal function					

Relationship between HbA1c parameters and severity between D dimer and severity

The mean HbA1c levels across the grades of severity were not significantly different. D dimer levels showed an increasing trend across the grades of severity. The difference in mean D Dimer levels across the stages of severity was found to be statistically significant. (Table 6)

Relationship between HbA1c parameters and severity				
Severity	**Mean**	**SD**	**F**	**p**
Mild	7.358	1.7965	3.915	0.141
Moderate	7.595	1.6342		
Severe	7.459	1.4265		
Relationship between D dimer and severity				

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

Severity	Mean	SD	F	p
Mild	291.32	265.767	77.91	0.001
Moderate	460.09	481.539		
Severe	715.69	635.729		

Table 6: Relationship between HbA1c & severity and between D dimer & severity

Discussion

It was observed that among 630 subjects included in the study, majority of 174 (27.6%) were in the age group of 31 to 40 years. At least, 58 (9.2%) were less than 30 years of age. Among 630 subjects included in the study, majority of 445 (70.6%) were males and 185 (29.4%) were females. This is in contrast to the study of Gopal P et al, "the mean age of the study population was 57.56 (±1.445) years. The percentage of males (48.3%) and females (51.7%) were almost equal".[4]

"In a study conducted by Alguwaihes et al. with 439 study participants, the median age was 55 years. However, the male-to-female ratio was 2:1 which differed which is similar to our study as we observed male predominance compared to females".[5] "In another study by Ciardullo et al., which included 373 participants, the mean age was 72 (±14) years with 65.4% males and 34.6% females which is comparable to the present study".[6] Because of a small sample size or due to a difference in local demographics there may be difference in the literature studies.

The majority of the patients 314 (49.8%) had mild, 232 (36.8%) had moderate and 84 (13.3%) had severe illness as per CT scores. Mortality was more common among subjects with severe grade 26 (31.0%) and least with mild grade 6 (1.9%). The association between severity grade and mortality was found to be statistically significant in our study. In India, mortality rates varied widely. In the study of Kerai et al, [7] non-survivors accounted for 53% of the ICU admission and 26.1% in Zirpe et al. "Various studies across the world have reported both early and late predictors of mortality. The common predictors included higher age, BMI, SOFA scores, D dimer and lower PaO2 to FiO2 ratio. [9-10] Overall mortality in the cohort study by Kajal K et al was 43.2% which is higher than mortality rates reported across the world.[11] Indian studies have also analysed predictors of mortality of which male gender, increasing CT score and need for mechanical ventilation were the prominent ones".[8]

Classic changes for COVID-19 were represented in chest X-ray (CXR) of 32 patients (26.6%)in the study of Gopal et al. Out of 25, 6.88 was the average CT severity score. Uncontrolled diabetic group (45.9%) had significantly higher CXR changes than the controlled diabetic group (18.07%). A significantly greater CT severity score was seen in the uncontrolled diabetic group (9.32) as compared to the controlled diabetic group (5.79).[4] There is extensive lung involvement in patients with uncontrolled diabetes as indicated by CT severity scores. When compared with patients with controlled diabetes these radiological findings indicate more severe pneumonia in patients with poor glycemic control.

On admission, the fasting sugar level (BSL-F) was 282.2 mg/dl in the uncontrolled group as compared with 160.6 mg/dl in the controlled diabetes group while 198.1 mg/dl was the mean total as found in the study of Gopal et al. [4] In the present study mean BSL levels were 181 ± 81.44. Secondary systemic complications like sepsis with or without septic shock, acute coronary syndrome, acute kidney injury, acute hepatic injury, DKA, pulmonary thromboembolism, and CVA were more common in diabetic patients especially in patients with uncontrolled diabetes as demonstrated by several studies and the same being reflected in our study. This may be due to the increased inflammatory markers causing an inflammatory response with cytokine storm leading to multisystem involvement in COVID-19 patients with uncontrolled diabetes.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

Among 630 subjects included in the present study, the majority 405 (64.3%) had SpO_2 levels of more than 94% at the time of admission, and 282 (44.8%) were either newly diagnosed or had previous cases of diabetes mellitus. The majority of the patients, 405 (64.3%) had symptoms onset between 8 and 14 days and 184 (29.2%) had less than 7 days. The majority of 209 (33.2%) had hypertension, 50 (7.9%) had IHD, 9 (1.5%) had CKD, and 1% of subjects had tuberculosis, COPD, hypothyroidism and CVA. Among 630 subjects included in the study, mean ferritin levels were 181 ± 81.44, mean LDH level was 94.03 ± 14.93, and mean HbA1C was 7.45 ± 1.68. Secondary systemic complications like sepsis with or without septic shock, acute coronary syndrome, acute kidney injury, acute hepatic injury, DKA, pulmonary thromboembolism, and CVA were more common in diabetic patients especially in patients with uncontrolled diabetes as demonstrated by several studies and the same being reflected in our study.

The mean NLR was 5.51 ± 2.41, the mean WBC count was 7238.38 ± 4942.23 and the mean hematocrit was 39.69 ± 4.80. The mean D dimer level was 402.29 ± 424.70, median levels were 260 (170-450). "A study by Chen et al. showed that plasma CRP levels had a positive correlation with the severity of COVID-19 infection and higher CRP levels were associated with a longer duration of hospital stay."[12] "A study by Herold et al. concluded that CRP levels were highly predictive of the need for mechanical ventilation".[13] In our study 503 (79.8%) had CRP levels more than 5 and 127 (20.2%) had levels less than 5. In the study of Gopal et al. "CRP levels were significantly higher in uncontrolled diabetes group CRP (9.40 mg/L) as compared with controlled diabetes group CRP (5.66 mg/L) and found an increased duration of hospital stay as well as increased mortality in patients with uncontrolled DM". [4]

The mean duration of the hospital stay was 9.18 days ± 4.34 days. The majority of the patients 428 (67.8%) had a duration of stay in the hospital between 6 and 10 days followed by 112 (17.8%) who stayed between 11 and 15 days. 300 (47.62%) patients received oxygen through nasal prongs, 158 (25.08%) through VM vent, 120 (19.05%) through NHF, 68 (10.79%) through BIPAP and 588 (93.3%) of the patients received nebulisation. "A study by Seiglie et al. demonstrated that patients with uncontrolled DM were at a significantly higher risk for ICU admission, increased duration of ICU stay, and the need for oxygen supplementation and mechanical ventilation. It also showed significantly higher mortality in patients with uncontrolled DM as compared with patients with good glycemic control".[14]

Among 630 subjects included in the present study, the majority of 584 (92.7%) have recovered/were discharged from the hospital and 46 (7.3%) succumbed to the illness. Fever (58.3%) was the most common clinical feature on presentation followed by cough (45.0%), fatigue (20.0%), and dyspnoea (11.25%) in the study by Gopal et al. The presenting complaints were fever (75.2%) and cough (70%) and one in every five patients also had vomiting (23.1%) and diarrhoea (21.3%).[5] in a study by Alguwaihes et al. 82.6% had fever and 39.1% had a cough on presentation in another study by Ciardullo S. et al. In our study, majority of the patients, 570 (90.5%) had fever, 493 (78.3%) had cough, 286 (45.4%) had breathlessness, and 66 (10.5%) had a sore throat. Other symptoms included vomiting, and loose motion in17 (2.7%).

"A meta-analysis and systemic review by Cheng et al. showed that COVID-19 patients with diabetes had significantly higher levels of serum ferritin and were associated with poorer outcomes.[15] In the study of Gopala et al, patients in the uncontrolled diabetes group had higher ferritin levels (352 μg/L) compared with the controlled diabetes group (238 μg/L)".[4]

"A systematic review by Rostami et al. showed that diabetic individuals with COVID-19 had higher D-dimer levels compared with non-diabetic individuals and were more likely to develop severe illness."[16] This is comparable to the present study, the difference in mean D Dimer levels across the stages of severity was found. In Gopal et al "study, patients with uncontrolled diabetes showed higher D-dimer levels (668.2 mg/dL) compared with the

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

controlled diabetes group (457.9 mg/dL)".[4] In the present study, the mean values of ferritin, LDH, BSL and IL6 showed an increasing trend across the grades of severity and the stages were found to be statistically significant. There is a higher susceptibility of such patients to develop an inflammatory (cytokine) storm which in turn may be associated with a significant rise in D-dimer levels as suggested by the increased ferritin levels. The mean values of BUN and creatinine; sodium and potassium; SGOT and SGPT showed an increasing trend across the grades of severity. The difference in mean SGPT levels across the grades of severity was found. "This is in accordance with the study of Gopal et al, inflammatory biomarkers such as D-Dimer, ferritin, and CRP were markedly elevated in the uncontrolled diabetes group as compared with the controlled diabetes group and this correlated with the increased severity and poorer outcomes seen in this group."[4]

"In the study of Gopal et al. on admission, HBA1c (mean) in the uncontrolled diabetes group was 10.8% as compared with 6.97% in the controlled diabetes group."[4] In our study, the mean HbA1c levels across the grades of severity were not significantly different. D dimer levels showed an increasing trend across the grades of severity.

Limitation of the Study

This study was carried out at a single centre. To further assess the epidemiology of Covid 19 Pneumonia, a multicentric study with a geographically diverse population is required.

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Conclusion

This retrospective observational study confirmed that 630 COVID-19 patients were admitted, and overall mortality was 7.3%. Mortality was higher in severe illness patients as per CT scores. At admission the important predictors of mortality in critically ill patients were the inflammatory biomarkers and high CT severity index. Prediction of the need for invasive ventilation was done by inflammatory markers like CRP, high NLR and D dimer independently. In future outbreaks of similar kinds this information may be useful in early triaging and resource management.

Author declaration

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- Was Ethics Committee Approval obtained for this study? Yes

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