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Original Research Article

Evaluation of COVID-19 patients requiring oxygen therapy in a tertiary care teaching hospital

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ABSTRACT

Background: COVID-19 disease is a public health emergency and declared as a pandemic in March 2020 by World Health Organization (WHO). Our aim was to study the clinical features, laboratory profile and outcome of COVID-19 patients needing oxygen therapy.
Methods: All patients diagnosed to be having COVID-19 and SpO_2 less than 94% on admission were included in the study. Detailed history, systemic examination and investigations were done and data was analyzed.
Results: Out of 100 patients studied, 66% were males and 34% were females. Comorbidity was seen in 83% of cases, predominantly hypertension (30%) followed by diabetes mellitus (27%) and ischemic heart disease IHD (11%). Most common presenting complaints were breathlessness (84%) followed by dry cough (63%) and fever (48%). Mean values of absolute counts of neutrophils, lymphocytes, eosinophils and basophils were 4,835 cells/cu.mm, 1,332 cells/cumm, 66 cells/cumm and 86.5 cells/cumm respectively. Serum C-reactive protein (CRP) was raised in 90%, lactate dehydrogenase (LDH) in 96% and D-dimer in 64 % of cases on admission. Incidence of happy hypoxia was 16%. Mortality in our study was 2%. Greater the values of serum CRP, LDH, ferritin, lesser was the SpO_2 of patients and greater the oxygen requirement. However no such correlation was found between D-Dimer and SpO_2 of patients and their oxygen requirement.
Conclusions: COVID-19 has varied presentations. The most common comorbidity was hypertension followed by diabetes mellitus. Serum inflammatory markers are raised in COVID disease. Eosinopenia can be a pointer towards COVID disease. One should be aware of the entity happy hypoxia seen in these patients.

Keywords: COVID-19, Clinical features, LDH, CRP, D-dimer, SpO_2

INTRODUCTION

Severe acute respiratory distress syndrome corona virus-2 (SARS-CoV-2) 2019 disease was declared as a pandemic by World Health Organization (WHO) in March 2020. It started in Wuhan city of China in December 2019 and infiltrated many countries such as United States of America (USA), Italy, Europe, and India. It is a ribonucleic acid (RNA) virus which belongs to the same family as Middle East respiratory syndrome virus (MERS-CoV). It manifests as flu-like illness but in some cases it causes severe lung injury, multiorgan failure and death.[1] It is a beta coronavirus with a genome like that of bat coronavirus. It attaches to angiotensin converting enzyme (ACE).[2] It spreads via aerosols, droplets and direct contact from human to human. Till 29 September 2021, India has recorded 3.37 crore cases and 4.47 lakh deaths.[3]

Maharashtra is the state most severely affected by COVID disease. SARS-CoV-2 disease has variable presentation and uncertain mortality. Various treatment modalities from hydroxychloroquine to steroids, antivirals to immunosuppressants have been tried with stars rising and setting.[4] We undertook this study to understand the clinical

aspects, laboratory profile and outcome of COVID-19 patients.

Aim

Aim of the study was evaluation of COVID-19 patients requiring oxygen therapy in a tertiary hospital.

Objective

Objectives of the study were: to study the clinical profile of COVID-19 patients needing oxygen therapy; to study the lab profile of COVID-19 patients needing oxygen therapy; to find incidence of patients having happy hypoxia; and to study the outcome in form of survival or death.

METHODS

Type of study

The study was a prospective observational type of study. The study was conducted at Bharati hospital research centre and general hospital, Pune between June to September 2020.

Inclusion criteria

Patients diagnosed as COVID positive by throat swab reverse transcriptase-polymerase chain reaction (RT-PCR), having SpO_2 less than 94% and requiring oxygen therapy on admission were included in the study.

Exclusion criteria

Patients needing ventilatory support on admission were excluded from the study.

Sample size

Sample size was found to be 100.

Informed verbal consent was taken from the patients before conducting the study and ethical approval was taken by ethical committee.

All symptomatic patients diagnosed to be having COVID-19 by throat swab RT-PCR with SpO_2 less than 94% requiring oxygen therapy on admission were included in the study. Detailed history with special note to cough, fever, sore throat, myalgia, fatigue, breathlessness, loose motions, vomiting, anosmia, loss of taste or any other presenting symptoms was made. Any history of comorbidity in the form of diabetes mellitus, hypertension, ischemic heart disease (IHD), chronic kidney disease (CKD) was also noted. Systemic examination was done in all patients. Laboratory investigations including complete blood count (CBC), blood sugar levels, renal function test, serum CRP, LDH and D-dimer were done in all patients. All patients were subjected to X-ray chest posteroanterior (PA) view, electrocardiography (ECG) and arterial blood gas (ABG) if indicated. They were treated with methylprednisolone, lower molecular weight heparin and remdesivir as indicated. They were put on nasal oxygen so as to maintain SpO_2 of 98% or above. Outcome was recorded in the form of death/survival.

Statistical package for the social sciences (SPSS) version 25 was the software used for data analysis.

RESULTS

In our study, 9% patients were in the age group between 20 to 30 years, 19% in 31-40 years, 17% in 41-50 years, and 31% in 51-60 years while 24% were above 60 years of age. 66% were males and 34% were females. 3 patients during course of illness developed persistent hiccups 2 patients had conjuctivitis and stomatitis in 1 patient. In our study, common presenting symptom was breathlessness (84%), cough (63%), generalized weakness (53.6%), fever (45%) and others shown in the graph (Figure 1). 83% of our patients had some comorbidity, mainly, 30% had hypertension, and 27% had diabetes mellitus (Figure 2).

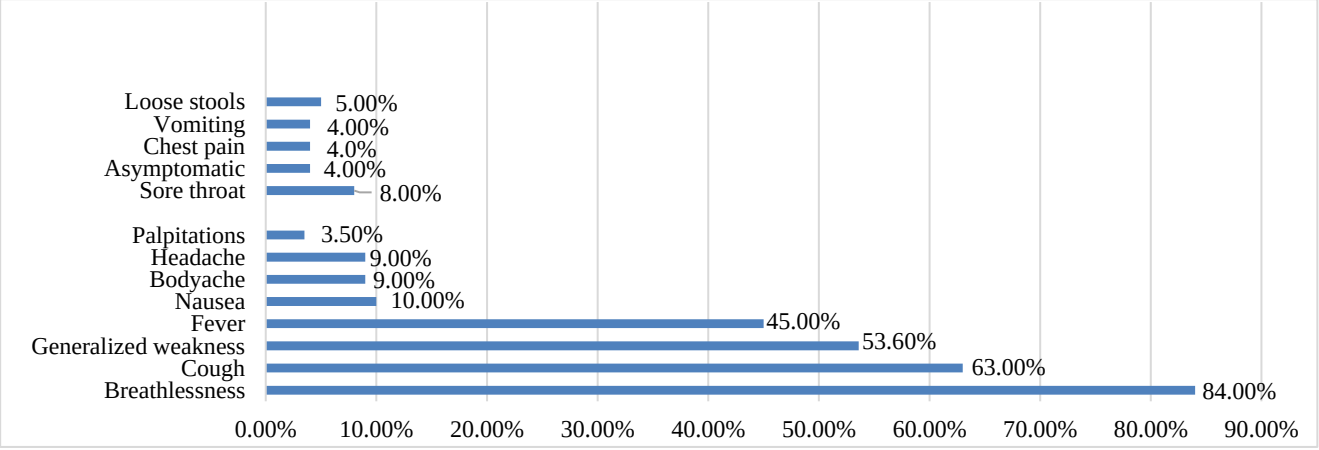

Figure 1: Percentage of different presenting symptoms in COVID-19 patients.

Table 1: Mean and median values of laboratory investigations, SpO_2 and oxygen requirement of study patients.

Variable	N	Mean	Sd	Median
Haemoglobin (g/dl)	100	12.5	2.5	12.8
TLC (cells/cumm)	100	6696.0	2671.6	6250.0
Neutrophils (cells/cumm)	100	4835.2	2382.1	4419.5
Eosinophils (cells/cumm)	100	66.8	99.0	54.0
Basophils (cells/cumm)	100	86.6	198.5	0.0
Platelets (cells/cumm)	100	236070.0	84117.3	223000.0
SpO_2 on admission (%)	100	88.1	5.8	90.0
O_2 requirement	100	5.4	3.3	4.0
CRP (mg/l)	100	112.2	99.8	90.4
LDH (U/l)	100	710.8	362.7	666.0
Ferritin (ng/ml)	100	538.8	763.6	375.5
D-dimer (ng/ml)	100	730.1	1557.2	315.2

Table 2: Correlation of SpO_2 on admission with inflammatory marker level.

Parameters	CRP	LDH	Ferritin	D-dimer
SpO_2 correlation	-0.2225	-0.2920	-0.3698	-0.1007
P value	0.0261	0.0032	0.0002	0.3189

Table 3: Correlation of O_2 requirement with inflammatory marker level.

Parameters	CRP	LDH	Ferritin	D-dimer
O_2 requirement correlation	0.2000	0.3138	0.2490	0.1564
P value	0.460	0.0460	0.0125	0.1202

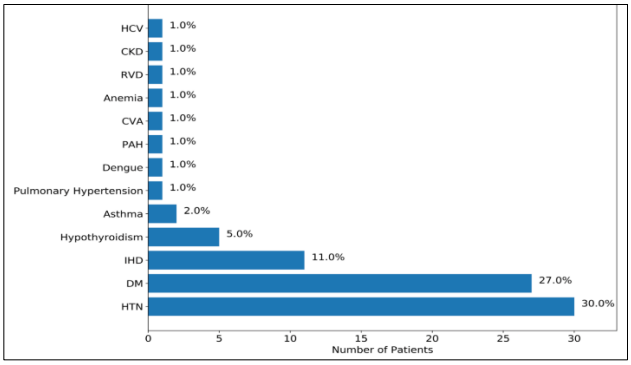

Figure 2: Percentages of various comorbidities in COVID-19 patients.

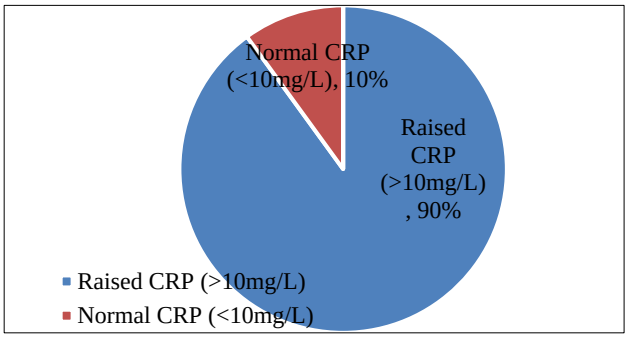

Figure 3: Distribution of serum CRP values in COVID-19 patients.

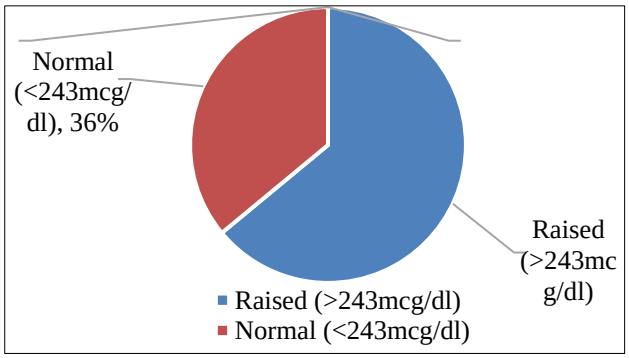

Figure 4: Distribution of D-dimer values in COVID-19 patients.

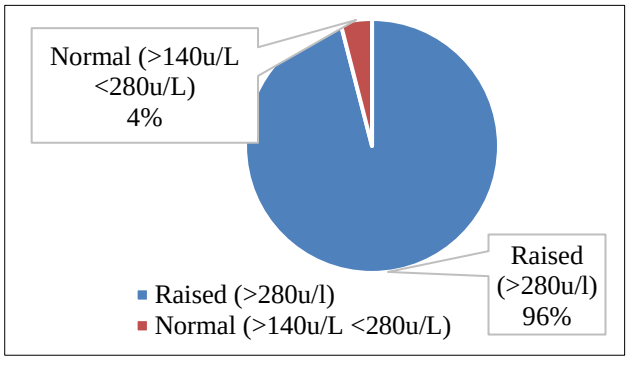

Figure 5: Distribution of serum LDH levels in COVID-19 patients.

Out of 100 patients studied, 98% got discharged on 10th day since admission while 2% patients died. 3 patients worsened during hospitalization and required critical care, but recovered. All of them received methylprednisolone and low molecular weight heparin. remdesivir and tocilizumab was given as indicated along with symptomatic treatment and multivitamins.

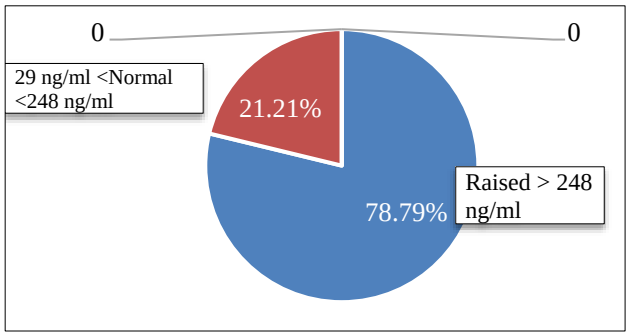

Figure 6: Distribution of serum ferritin level in COVID-19 male patients.

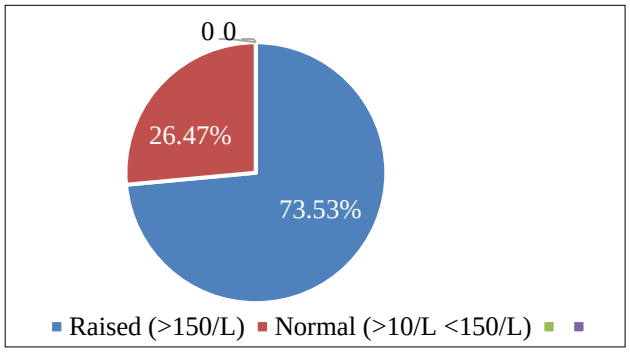

Figure 7: Distribution of serum ferritin levels in female COVID-19 patients.

DISCUSSION

There are studies demonstrating that males are affected more than females. Meta-analysis by Ueyama et al included 3,494 patients of which 55.4% were males and 44.6% were females. WHO and Europe and Chinese Centre for Disease Control and Prevention (CDC) also found that COVID-19 was seen in males more than females; 53.6% versus 46.4% and 51.4% versus 48.6% respectively.

Male predominance was seen in severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) too. The possible reasons may include smoking habits, higher ACE expression in males, lack of protective effect of oestrogen and more outdoor lifestyle in males.[5] Meta-analyses on COVID-19 comorbidities found hypertension as the most common comorbidity as seen in 15.8% cases, followed by cardiovascular and cerebrovascular conditions in 1.7% and diabetes mellitus in 9.4% cases. Less common comorbidities found were human-immunodeficiency virus (HIV) infection, hepatitis C infection (1.87%), malignancies (1.5%), respiratory illness (1.4%), renal diseases (0.1%) and immunodeficiencies (0.01%). Patients with comorbidities should be extra vigilant in taking precautions.[6]

Most common main symptom with which our patients presented were breathlessness (84%), followed by dry cough (63%) and generalized weakness (53%). Percentage of breathlessness was high as our inclusion criteria was patients with SpO_2 on admission less than 94% on room air. It needs emphasis here that fever is not present in all patients, hence only screening patients with digital thermometer is not good enough.

16% of patients had SpO_2 equal or less than 90% but were not breathless, although they had some other symptoms. They may be suffering from happy hypoxia which is a confusing entity for physicians. It is the carbon dioxide and not low oxygen saturation that stimulates receptors in brain and causes shortness of breath. The ventilator response to hypoxia is characterized as a hyperbolic curve. Minute ventilation is unchanged as PaO_2 drops from 90 to 60 mmHg; further increases in PaO_2 provoke an exponential increase in minute ventilation. Severe hypoxia elicits an effective increase in ventilation only when background $PaCO_2$ exceeds 39 mmHg. A disproportionate number of COVID-19 patients are elderly and diabetic; both factors that blunt the response of the respiratory control system to hypoxia. A wide variability in chemical drive to breathe in response to hypercapnia and hypoxia is another factor that explains why some hypoxic patients do not develop dyspnoea. A shift in the oxygen dissociation curve is another confounding factor. Fever, prominent with COVID-19, causes the curve to shift to right, hence any given PaO_2 will be associated with a lower SaO_2. Whether SARS–CoV-2 gains access to the brain through the olfactory bulb and contributes to the association between anosmia-hyposmia and dyspnoea and whether ACE-2 receptors play a role in the depressed dyspnoea response in COVID-19 remains to be determined.[7]

In our study 93% COVID patients had total leucocyte count (TLC) less than 11,000 cells/ cumm and only 7% had TLC above 11,000 cells/cumm. Mean TLC was 6,696 cells/cu.mm. Mean values of absolute counts of neutrophils, lymphocytes, eosinophils and basophils in our study were 4,835 cells/cumm, 1,332 cells/cumm, 66 cells/cumm and 86.5 cells/cumm respectively. They were not in the range to call it as cytopenias, but definitely low neutrophil and eosinphil counts were seen in COVID patients in our study as seen in many other studies.[8] This can be due to direct effect of the virus on immune system. 30% patients had zero eosinophil count, whether this increases risk of severity of COVID infection is not yet known. Eosinopenia can be due to decreased production and release from bone marrow or increased apoptosis due to interleukin-1 in circulation.[9]

In our study CRP was raised in 90% of cases and normal in 10% of cases (Figure 3). The mean value was 112.2 mg/l

which was high as compared to other studies as we included patients requiring oxygen therapy.

CRP is an exquisitely sensitive marker of acute inflammation, infection and tissue damage. It rises within 6 to 8 hours of inflammation becomes maximum in 48 hours and reduces as inflammation settles.[10] We found that higher the level of CRP on admission, lower the SpO_2 and higher the oxygen requirement (Table 2). LDH at admission was high in 96% of cases and normal in 4% of cases. Its mean value was 710 u/L (Figure 5). It was seen that with increase in oxygen requirement and decreased levels of SpO_2 levels of LDH increased in our study.

LDH is an intracellular enzyme present in all organ system. Lung contains LDH isoenzyme 3. It was seen in studies that LDH is elevated in severe COVID-19 cases as compared to less severe cases.[11] D-dimer was raised in 64% of cases (Figure 4) and the mean value was 730.15 mcg/ml, however there was no correlation between D-dimer and SpO_2 or oxygen requirement (Table 2 and 3). Bilian found that D-dimer was elevated in COVID-19 patients but there was no correlation with increased risk of venous thromboembolism and it will not be correct to decide about anticoagulation looking at the values.[12] There are studies depicting that in severe COVID disease D-dimer is elevated more as compared to less severe disease.[13] Among COVID positive patients, 78.79% males had raised serum ferritin level while, it was raised in 73.53% female patients (Figure 6 and 7).

Our study depicts role of simple supplemental oxygen therapy in COVID patients. In settings where there is a shortage of ventilators or high flow nasal oxygen due to rising cases simple oxygen therapy by nasal mask or prongs can save the patient. Mortality in our study was only 2%.

CONCLUSION

COVID-19 disease has varying presentations. Most common predominant symptom was breathlessness, cough followed by fever. Our study group consisted of patients requiring oxygen. All COVID-19 patients do not have fever, hence screening by digital thermometer alone may not pick up cases. Some rare presentations which developed after admission were conjunctivitis in two patients, persistent hiccups in three patient and stomatitis in one patient. The most common comorbidity was hypertension followed by diabetes mellitus, hypothyroidism, bronchial asthma, pulmonary hypertension, dengue fever, cerebrovascular accident, anemia, retroviral disease, chronic HCV infection and chronic kidney disease. The incidence of happy hypoxia was 16 %. 93% COVID-19 patients had TLC less than 11,000 cells/ cu.mm and mean TLC was 6,696 cells/cumm. Low neutrophil and eosinophil counts were seen in COVID-19 disease. Eosinophil count was zero in 30% of cases in our study. CRP was raised on admission in 90%, LDH in 96% Serum ferritin in 71.21% in males, 73.53% in females and D-dimer in 64% of cases. We found greater the values of CRP, serum ferritin and LDH lesser was the SpO_2 of patients and greater the oxygen requirement. We found no correlation of D-dimer values with SpO_2 of patients or their oxygen requirement.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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