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Research Article

CLINICO-EPIDEMIOLOGICAL PROFILE OF COVID-19 PATIENTS ADMITTED TO TERTIARY CARE MEDICAL COLLEGE HOSPITAL IN SOUTH INDIA

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ABSTARCT

Objective: This is a retrospective study done in tertiary care medical college hospital in south India to look for clinico-epidemiological profile of coronavirus disease 2019 (COVID-19) patients admitted to the intensive care unit (ICU). This study can help us in identifying the risk factors leading to increased mortality. Hence, identifying these factors can help us in modifying the treatment depending on the risk factors that are present.

Methods: All patients who are diagnosed with COVID-19 with reverse transcription polymerase chain reaction positivity admitted to ICU are enrolled. Data are collected retrospectively by analyzing the medical case records and looking for all parameters, such as age, sex, underlying comorbidity, method of oxygen therapy, degree of severity, and inflammatory markers. All these data are analyzed and compared between survivors and non-survivors.

Results: 81% were male patients in comparison to female patients contributing to 19%. 55% were <60 years and 45% were >60 years. Non-survivors had a mean age of 64.5 years. Average days of hospital admission, ICU admission, and onset of hypoxia after symptom onset were 4.2 days, 8.5 days, and 7.8 days, respectively. Average PaO_2 and P/F ratio was 81.25 and 165.9, respectively. The average P/F ratio in non-survivors was 144 compared to survivors having 187. The average high-resolution computed tomography score on admission and discharge was 12.4 and 11.9, respectively. Regarding inflammatory markers average lactate dehydrogenase (LDH), Ferritin, and interleukin-6 were 462, 618.2, and 130.56, respectively. Non-survivors had increased LDH with a mean of 538.3 when compared to survivors having a mean of 421.4.

Conclusion: This study showed that there is increased mortality with an increase in age, especially >60 years. Severe respiratory failure with P/F ratio<144 had increased mortality. Patients with increased LDH showed an increase in mortality.

Keywords: Coronavirus disease 2019, Intensive care unit admission, Severe respiratory failure.

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) has affected worldwide; every country has experienced the burden of the disease. COVID-19 has become a major public health problem. The World Health Organization (WHO) has declared COVID-19 as a global pandemic on March 11, 2020 [1]. As of September 2024, a total of 776.4 million cases were reported globally, and 7.06 million deaths were reported. India reported the third largest number of 45 million cases after the USA (103 million) and China (99.4 million) cases, and also third largest in mortality with 534 thousand deaths next to the USA (1.2 million) and Brazil (702 thousand) till September 2024 as per the WHO documentation. In India, the first confirmed case of COVID-19 was reported from the state of Kerala on January 2020 [2]. Tamil Nadu has 35,74,041 cumulative cases and 38,086 deaths till September 2024 as per the Ministry of Health and Family Welfare, Government of India.

COVID-19 is a disease with various clinical symptoms ranging from asymptomatic carriers to patients developing severe acute respiratory distress syndrome (ARDS) requiring intensive care unit (ICU) admission and ventilatory management, and even death [3]. The incubation period for COVID is 5–13 days; this is not well documented in asymptomatic patients [4]. Mild disease is more common in the younger age group who has no underlying diseases and have good prognosis, whereas older patients and patients who have multiple comorbidities, such as immunosuppression, heart disease, lung disease, chronic kidney disease, and diabetes manifest with severe disease and has increased mortality [5]. Dyspnea, cough, and fever are the common presenting symptoms, and patients may present with severe hypoxia as there is disease progression leading to respiratory failure and mechanical ventilation [6]. Severe COVID-19 may progress to multi-organ failure with acute kidney injury, coagulopathy, severe shock, and death. There is elevated C-reactive protein, lactate dehydrogenase (LDH) in COVID-19 infection and it correlated with the severity and prognosis and also has extensive bilateral ground glass opacity of lungs noted in computed tomography (CT) scan which tells about the severity [7]. Case fatality rate (CFR) during 1st wave was reported to be 21% in the USA [8]. In India, CFR varied from state to state with the highest CFR in Maharashtra at 29.4% [9], and the lowest reported from Rajasthan at 2.23% [10].

Even younger age groups with specific comorbidities such as obesity have an increased risk of developing severe consequences of COVID-19 disease [11].

Socioeconomic status plays a major role in the development of severe COVID-19 disease. Since India is a vast country and has a diverse population and also different health infrastructure between different places, which also impacts the development of severe COVID-19 disease. Being a highly populated country the spread of disease is fast. Hence in this study, we try to identify the socioeconomic profile of the patients admitted with severe COVID-19 disease in the critical care unit.

METHODS

This was a retrospective study done in COVID-19-positive patients who were admitted in the ICU in a tertiary care medical college hospital

in Coimbatore, India. A total of 153 patients aged>18 years were admitted in the ICU out of 1907 total admissions. The study period was from May 2022 to December 2022. The data on age, gender, clinical symptoms and signs, co-morbidities, laboratory tests, and outcomes, such as duration of hospitalization, duration of ICU stay, and mortality were collected from the hospital medical records. Oxygenation parameters, such as PaO_2 and P/F ratio were collected. Details of oxygen therapy such as the need for mechanical ventilation, non-invasive ventilation (NIV), and high-flow nasal cannula (HFNC) were recorded. High-resolution CT (HRCT) score was also collected to know about the severity.

The ICU admission criteria for COVID-19 patients typically included oxygen requirements, respiratory failure, shock, acute organ dysfunction, and a high risk of clinical deterioration. Patients with severe symptoms, such as respiratory rates ≥30 breaths/min, oxygen saturation ≤93%, and lung infiltrates >50%, require close monitoring. Deaths were defined based on the Indian Council of Medical Research criteria for COVID-19 provided by the WHO. The definition included deaths resulting from clinically compatible illness in a probable or confirmed COVID-19 case unless there is a clear alternative cause of death that cannot be attributed to COVID-19 disease. The discharge criteria of patients from the ICU were done based on the hospital and Tamil Nadu government guidelines.

The data were entered in Excel and analyzed using (Statistical Package for the Social Sciences Inc., Chicago, IL, USA, version 23.0 for Windows). For continuous variables, mean (standard deviation) or median (25^{th}–75^{th} centiles [range]) and for categorical variables, frequency and percentages were presented. The continuous variables were compared using Student's t-test or Kruskal–Wallis test and the significance level adopted was 5% ($p<0.05$).

Data were also analyzed between survivors and non-survivors to identify significant factors contributing to mortality.

RESULTS AND DISCUSSION

Our study included 153 patients who were admitted to the ICU out of 1907 patients admitted to the hospital. Our study had predominantly male patients consisting of 81.6% compared to females of 18.3%. Our study had more patients with <60 years of age accounting for 55.55% in comparison to patients with >60 years accounting for 44.44% (Table 1 and Fig. 1). Average age of admission was 59 years (Fig. 2).

The average day after symptom onset for admission in our study was 4.2±3.8 days, onset of hypoxia was 7.8±5.2 days, and admission to ICU was 8.5±5.3 days (Table 2). Figueroa *et al*. published in his study that the median duration of time to admission from time of symptom onset is 7 days [12]. Huang *et al*. also demonstrated that the median duration of symptom onset is 8 days in their study [13]. The earlier day of admission may be due to an increased number of cases in our region compared to their population and reported cases. Oda *et al*. did a study and found out that the average day of onset of hypoxia is 6 days which is slightly lower than our study which may be because of less awareness in our population and tolerated hypoxia very well, and the average day of admission to ICU is 8 days which is similar to our study [14]. Yang *et al*. did a study in the Chinese population also showed average days of ICU admission is 9.5 days [15]. Sinatti *et al*. showed that PaO_2 was 58.10–74.88 which was very much comparable to our study which had an average PaO_2 of 81.25±38.35. Our study showed an average P/F ratio of 165.9±99, but previous studies showed a wide range depending on the day of admission to ICU (117.4–322.0) [16]. Grasselli *et al*. did a study that showed an average P/F ratio of 160 mmHg which was very much comparable to our study [17]. Our study has shown that the average CT score on admission to the ICU was 12.20±4.5, which indicated that a score of >12 had a severe disease needing ICU admission. Yazdi *et al*. has shown that a CT score mean of 11.10 ± 9 has a high risk of ICU admission [18]. Another study has also shown that a

Table 1: Baseline characteristics of patients hospitalized in ICU with COVID-19

Baseline parameter	n (%)
Gender	
Male	125 (81.6)
Female	28 (18.3)
Age	
<60 years	85 (55.55)
>60 years	68 (44.44)

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019

Table 2: Clinical profile of patients hospitalized in ICU with COVID-19

Disease severity	Mean±SD
Disease progression	
Hospital admission (days)	4.2±3.8
ICU admission (days)	8.5±5.3
Onset of hypoxia (days)	7.8±5.2
Oxygenation index	
PaO^2	81.25±38.35 mmHg
P/F ratio	165.9±99 mmHg
HRCT score	
On admission	12.20±4.5
On discharge	11.9±4.3

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019

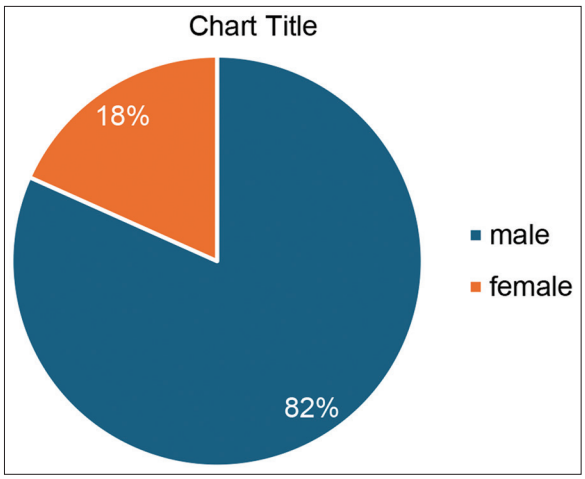

Fig. 1: Sex distribution of patients hospitalized in intensive care unit with coronavirus disease 2019

CT score <8 with SpO_2 ≤91 in elderly males has higher mortality and increased incidence of ICU admission [19]. Another study by Nagra *et al*. also reported that an increase in CT score is a strong predictor of ICU admission [20]. The inflammatory markers were LDH 462, ferritin 618.2, interleukin-6 (IL-6) 130.56 (Table 3). In our study, 38 (25%) patients admitted in the ICU required intubation and mechanical ventilation (Fig. 3). Out of these 38 patients, 36 patients (95%) died and only 2 patients survived. Other studies have showed overall mortality was 40% in mechanically ventilated patients [21]. Sjoding *et al*. did a study on mortality of COVID-19 patients which was also 38% [22]. The high mortality in our study is due to delay in presentation to ICU and also delay in mechanical ventilation. Hence, it was also noted that early mechanical ventilation prevents self-induced lung injury, which will help in reducing the mortality. 115 (75%) patients were managed with NIV in 54 (47%) patients, HFNC in 32 (28%) patients, and both HFNC and NIV used in the remaining 29 (25%) patients (Fig. 4). Out of 153 patients overall mortality was 57 (37%), remaining 96 (63%) of the patients shifted to ward. The WHO has estimated 48% all-cause

mortality in more than 20 countries [23] in between January 2020 and December 2021 period, which is more than what we noted in our study.

When comparing survivors and non-survivors our study showed that there was no difference in mean hospital stay (4.2±3.8 versus 4.2±3.0), and also there is no difference in ICU stay (8.0±5.1 versus 9.1±6). On comparing age, non-survivors are older than survivors with a mean of 64.5±11.8 versus 56.6±13.3 with p−0.0002 which is statistically significant (Table 4 and Fig. 5). Romero Starke *et al*. did a meta-analysis and found that there is increased risk of in-hospital and case mortality 5.7% and 7.4%, respectively, with increase in age by every year [24]. Our study was comparable to other studies which showed higher mortality in increased age in COVID patients with age being an independent factor as a mortality predictor. Bonanad *et al*. showed that there is the largest increase in the mortality risk with age >60 years [25].

Table 3: Inflammatory markers in patients hospitalized in ICU with COVID-19

Inflammatory marker	Mean
LDH	462
FERRITIN	618.2
IL 6	130.56

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019, LDH: Lactate dehydrogenase, IL-6: Interleukin-6

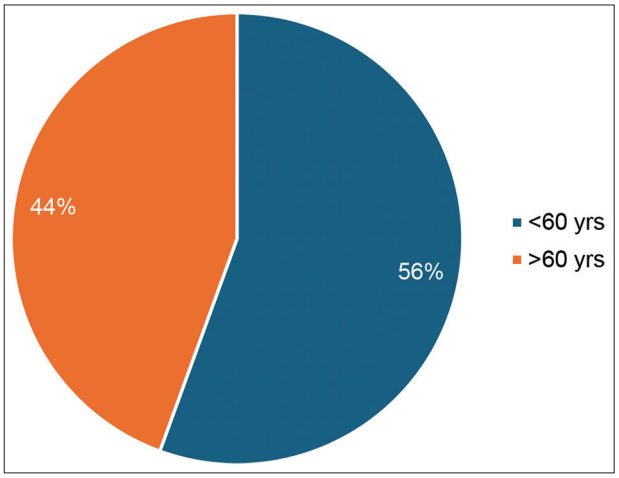

Fig. 2: Age distribution of patients hospitalized in intensive care unit with coronavirus disease 2019

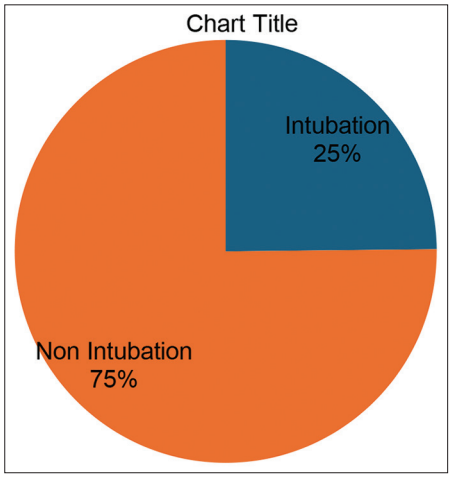

Fig. 3: Percentage of intubation versus non-intubation coronavirus disease 2019

When comparing survivors and non-survivors there was no significant difference in HRCT lung score (11.8±4.6 versus 12.61±4.8) and also there is no statistical difference in the day of onset of hypoxia in survivors and non-survivors (7.8±5.2 versus 8.1±5.7). When comparing the oxygenation index between survivors and non-survivors, PaO_2 showed no statistically significant difference (82±35.4 versus 80.5±41.3). On comparing P/F ratio which was low in non-survivors compared to survivors, respectively (144±93.1 versus 187.8±104.9), which was statistically significant with p=0.016 (Table 5 and Fig. 6).

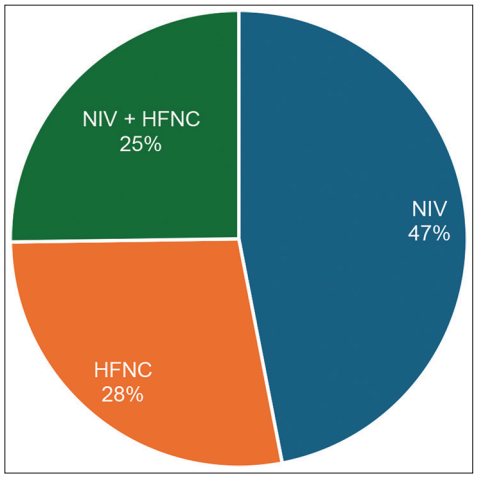

Fig. 4: Percentage of non-invasive management coronavirus disease 2019

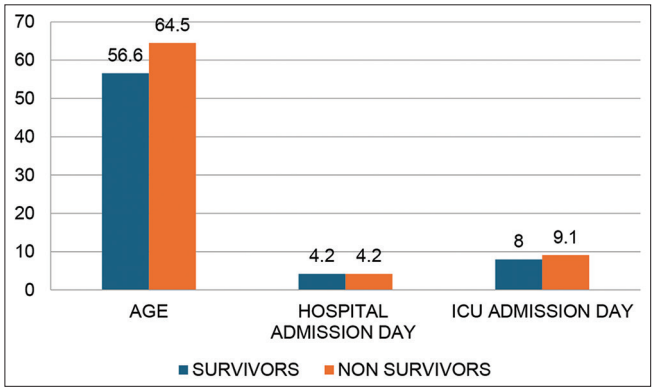

Fig. 5: Comparison between survivors' versus non-survivors hospitalized in the intensive care unit with coronavirus disease 2019 regarding demographic details

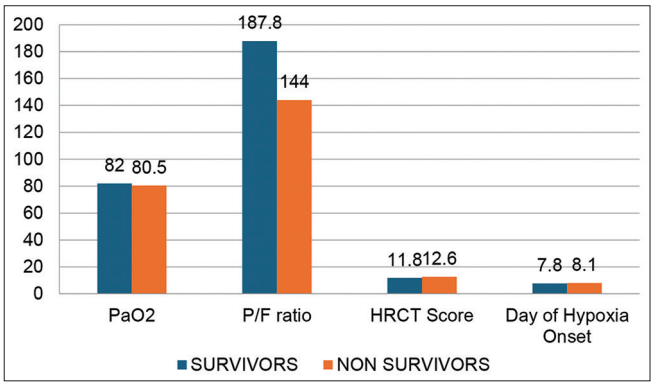

Fig. 6: Comparison between survivors' versus non-survivors hospitalized in the intensive care unit with coronavirus disease 2019 regarding clinical parameters

Table 4: Comparison between survivors' versus non-survivors hospitalized in ICU with COVID-19 regarding demographic details

Baseline parameter	Survivors (97)	Non-survivors (56)	p-value (<0.5)	95% CI
Age mean	56.6±13.3	64.5±11.8	0.0002 (S)	3.7–12.1
Hospital admission day mean	4.2±3.8	4.2±3.0	0.95	−1.15–1.21
ICU admission day mean	8.0±5.1	9.1±6	0.22	−0.7–2.92

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019

Table 5: Comparison between survivors' versus non-survivors hospitalized in ICU with COVID-19 regarding clinical parameters

Disease severity	Survivors (97)	Non-survivors (56)	p-value (<0.5)	95% CI
PaO^2 mean	82±35.4	80.5±41.3	0.81	−14.4–11.42
P/F ratio mean	187.8±104.9	144±93.1	0.016 (S)	−78–8.05
HRCT mean	11.8±4.6	12.61±4.8	0.36	−0.89–2.42
Onset of hypoxia days mean	7.8±5.2	8.1±5.7	0.74	−1.53–2.14

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019, HRCT: High-resolution computed tomography

Table 6: Comparison between survivors' versus non-survivors hospitalized in ICU with COVID-19 regarding biochemical parameters

Inflammatory markers	Survivors (97)	Non-survivors (56)	p-value (<0.5)	95% CI
Ferritin mean	641.6±450.5	624.6±575.8	0.91	−172.1–192
IL-6 mean	177.16±112.42	228.99±105.7	0.13	−47.9–351.5
LDH mean	421.4±149.5	538.3±211.1	0.0008(S)	49.9–183.9

ICU: Intensive care unit, COVID-19: Coronavirus disease 2019, LDH: Lactate dehydrogenase, IL-6: Interleukin-6

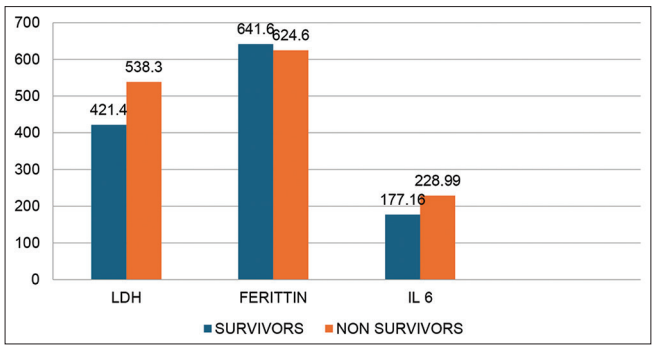

Fig. 7: Comparison between survivors' versus non-survivors hospitalized in the intensive care unit with coronavirus disease 2019 regarding biochemical parameters

Our study was comparable with previous studies, which showed P/F ratio as an independent predictor of mortality in COVID patients and showed P/F <130 has severe mortality risk irrespective of day of onset of ARDS [26,27].

When comparing survivors and non-survivors regarding inflammatory markers, there is no significant difference with IL-6 (177.16±112.42 versus 228.99±105.7), and ferritin (641.6±450.5 versus 624.6±575.8). Our study showed that there is an increase in mortality with an increase in LDH (538.3±211.1 versus 421.4±149.5) with a statistical p=0.0008 between non-survivors and survivors, respectively (Table 6 and Fig. 7). This result in our study was comparable to previous studies which showed increased mortality and increased risk of developing severe pneumonia which leads to ICU admission and mechanical ventilation with an increase in LDH [28,29]. Linarez Ochoa *et al.* showed that an increase in ferritin levels have increased mortality which was not in our study [30].

Our study had some limitations. Being a single center study it may not be a representation of the whole community. Second, it is a retrospective study extracting data from a case sheet, which may miss a few details. Third, comorbidity is self-declared which may not be reliable. Moreover, also the investigations were added or deleted depending on new guidelines and government norms.

CONCLUSION

Based on our observation we would suggest that patients in the elderly group with age >60 years have an increase in mortality. Furthermore, patients with multiple comorbidities had an increase in mortality. When patients present with severe ARDS with P/F <140 has increased mortality. With respect to inflammatory markers, our study doesn't show any significant difference in survival except LDH which showed increased LDH increases mortality.

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