e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(2); 769-773

Original Research Article

Assessing Clinical Characteristics as Predictors of COVID-19 Associated Mortality

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Received: 11-01-2024 / Revised: 28-01-2024 / Accepted: 06-02-2024
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Conflict of interest: Nil

Abstract:

Introduction: Clinical characteristics at presentation can help the healthcare professionals in determining severity and providing effective medical care, especially in absence of definite evidence-based pharmacotherapeutic options for patients with SARS-CoV-2.

Materials and Methods: The current retrospective, observational study was performed in a tertiary care hospital to determine the demographic and clinical factors associated with COVID-19 mortality in 996 patients with laboratory-confirmed SARS-CoV-2 infection. A logistic regression analysis with the binary outcome (survivor/non-survivor) was used to estimate the association between COVID-19 related mortality and demographic and clinical characteristics at admission.

Results: Of the 996 patients included, 60.34% were males. Among the patients included in our analyses, 240 (24.09%) died from COVID-19 related symptoms. The mean age of patients in the non-survivor group was significantly greater than survivor group (55.39±17.41 vs 45.56 ± 16.06, P<0.0001). Logistic regression analysis found that the odds of mortality were greater in patients with higher age [OR 1.72 (95% CI (1.65 - 1.9); P<0.0001]. Baseline clinical characteristics detected as risk factors for COVID-19 mortality include body temperature >99^{0}F [OR 1.507 (95% CI (1.159 - 1.959)], Pulse>100 [OR, 1.085 (95% CI 1.048 - 1.123)], severely high respiratory rate (OR, 1.82 [95% CI (1.551 - 2.136)], and poor oxygen (O_2) saturation (OR, 1.252 [95% CI 1.045 - 1.499]).

Conclusions: This study in patients with confirmed COVID-19 identified older age, body temperature >99^{0}F, pulse >100, high respiratory rate and poor oxygen saturation as risk factors for COVID-19-associated mortality. Instantaneous, objective measures obtained at the time of admission, can be effective predictors of mortality.

Keywords: SARS-COV-2, oxygen saturation, respiratory rate, fever, pulse.

Introduction

Recognizing the prognostic variables of a disease aids in enhancing the management strategies and improves the odds of survival, especially in absence of definite evidence-based pharmacotherapeutic options. [1]

In the recent COVID-19 pandemic during which healthcare professionals faced several challenges due to resource constraints, utilizing readily available methods for patient's disease severity assessment was essential. [2,3,4, Clinical characteristics at presentation can help the healthcare professionals in determining severity and providing effective and required level of medical care. We undertook the current study to determine the demographic and clinical factors associated with COVID-19 mortality in 996 patients with laboratory-confirmed SARS-CoV-2 infection. These could serve as prognostic markers in patients infected with SARS-CoV-2 infection without the need for laboratory investigations or expensive, time-consuming evaluations. This would reduce the time required for strategizing treatment decisions.

Material and Methods

Study Design

This was a retrospective observational study in patients who presented during April 2020-December 2021 and were subsequently admitted to our hospital. For this analysis, all cases (n = 996) with confirmed SARS-CoV-2 positive by real time-polymerase chain reaction (RT-PCR) in nasopharyngeal or oropharyngeal swabs collected in inpatient facilities were included. Demographic and

clinical data were extracted from electronic health records.

The dataset for analysis included: demographic variables namely age and sex, clinical variables - heart rate, pulse, body temperature, respiratory rate, and oxygen saturation recorded at admission.

Pregnant patients and those with severe comorbidities including renal impairment and cardiac disease were excluded.

This study was approved by the Institutional Ethics Committee. This was an observational study with no patient identifiable details and hence patient consent was waived.

Statistical analysis

Sample size calculation was not performed and data was retrieved during the study period of 8 months determined by the number of SARS-CoV-2 positive patients hospitalized at our hospital. A logistic regression analysis with the binary outcome (survivor/non-survivor) was used to estimate the association between COVID-19 related mortality and demographic and clinical characteristics at admission. Odds ratios (OR) for mortality relative to each predictor were estimated, and statistical significance was assessed relative to P value of < 0.05.

Results

As of December, 2021, a total of 996 patients with confirmation on RT-PCR for SARS-CoV-2 infection were admitted to our facility and their data was included for the analyses. Overall, 601 (60.34%) of patients were male, and the entire patient population was of Asian-Indian origin . The mean±SD age was 47.93±16.92 years. At admission, the respiratory rate was greater than 24 breaths/min in 402 (40.36%), temperature >990F in 851 (85.44%), pulse (>100 bpm) in 177 (17.77%) patients. Oxygen saturation was below 94% in 868 (87.14%) patients. Among the patients included in our analyses, 240 (24.09%) died from COVID-19 related symptoms. The demographic and clinical characteristics, of patients graded by survival are depicted in Table 1. Comparison of proportion of survivors and non-survivors on the basis of gender and presence of fever (body temperature >99oF) revealed no significant difference while pulse >100 bpm was noted in significantly greater proportion of patients in the non-survivor group (31.67% vs 13.36%; P<0.0001). Similarly respiratory rate was moderately (≥24-≤30 bpm) and severely (≥30breathspm) higher in significantly greater proportion of non-survivors (31.67% vs 24.34%; P=0.0244) and (54.17% vs 1.59%; P<0.0001), respectively. Hypoxemia occurred almost in twice the proportion of patients in non-survivor group compared to the survivors (87.50% vs 47.75%; P<0.0001). All the non-survivors were mechanically ventilated compared to only 0.93% in the survivor group.

Table 1: Demographic and Clinical characteristics of patients with SARS-CoV-2 infection

Variables	Total		Survivors		Non-survivors		P
	(n=996)	%	(n=756)	%	(n=240)	%	
Gender (%) Female	395	39.66	289	38.23	101	42.08	0.2873
Gender (%) Male	601	60.34	462	61.11	139	57.92	0.2873
Temperature >99ºF	851	85.44	641	84.79	210	87.50	0.2999
Pulse (>100bpm)	177	17.77	101	13.36	76	31.67	< 0.0001
Respiratory rate							
<24 breaths per minute	594	59.64	560	74.07	34	14.17	< 0.0001
Moderate (≥24-≤30 bpm)	260	26.10	184	24.34	76	31.67	0.0244
Severe (≥30breathspm)	142	14.26	12	1.59	130	54.17	< 0.0001
Oxygen saturation							
• Normal (≥94%)	129	12.95	122	16.14	7	2.92	< 0.0001
• Moderate (≤93-≥90%)	297	29.82	274	36.24	23	9.58	< 0.0001
• Severe (<90%)	571	57.33	361	47.75	210	87.50	< 0.0001
Methods of oxygen							
MV(C)	247	24.80	7	0.93	240	100.00	< 0.0001

Results of the univariate analysis are presented in

Table 2. Among the demographic variables, mean age [55.39±17.41 vs 45.56 ± 16.06; (95% CI 7.4463 to 12.2137; P<0.0001)], respiratory rate [31.10±6.43 vs 21.35±3.28 (95% CI 9.1312 to 10.3688; P<0.0001)], pulse [97.09±18.04 vs 89.63±11.74; (95% CI 5.4635 to 9.3965; P<0.0001)], and body temperature [99.93±1.05 vs 99.77±0.83; (95% CI 0.0309 to 0.2891; P=0.0152)] was significantly higher in the non-survivors compared to the survivors. The mean oxygen saturation [88.90±5.39 vs 77.40±10.52; (95% CI 12.5144 to -10.4856; P<0.0001)] was significantly lower in the non-survivors.

Table 2: Comparison of clinical variables as prognostic markers

Variables	Total (n=996) (Mean±SD)	Survivors (n=756) (Mean±SD)	Non survivors (n=240) (Mean±SD)	95%CI	Survivors' vs Non-survivors P value
Age (y)	47.93 ± 16.92	45.56 ± 16.06	55.39±17.41	7.4463 to 12.2137	<0.0001
SpO2 (%)	86.13 ± 8.53	88.90±5.39	77.40±10.52	-12.5144 to -10.4856	<0.0001
Respiratory rate (breaths/min)	23.70 ± 5.96	21.35±3.28	31.10±6.43	9.1312 to 10.3688	<0.0001
Pulse (bpm)	91.42 ± 13.85	89.63±11.74	97.09±18.04	5.4635 to 9.3965	<0.0001
Temperature (^{0}F)	99.81± 0.89	99.77±0.83	99.93±1.05	0.0309 to 0.2891	0.0152

Logistic regression analysis presented in Figure 1 detected increasing age as risk factors for COVID-19 mortality.

The odds of mortality was twice as great in those ≥60 years of age [OR 1.72 (95% CI (1.65 - 1.9)], P<0.0001 compared to those <60 years [OR 1.036 (95% CI (1.019 - 1.054)], P<0.0001. The odds of mortality amongst patients <18 years [OR 0.955 (95% CI (0.786 - 1.159)], P=0.6393 and between 18-39 years [OR 1.055 (95% CI (0.989 - 1.124)], did not differ significantly, P=0.1055.

While amongst patients aged between 40-60 years [OR 1.52 (95% CI (1.31 - 1.61)], P=0.01055 and >60 years [OR 1.72 (95% CI (1.65 - 1.9)], P<0.001 there was significant increase in odds of mortality outcome.

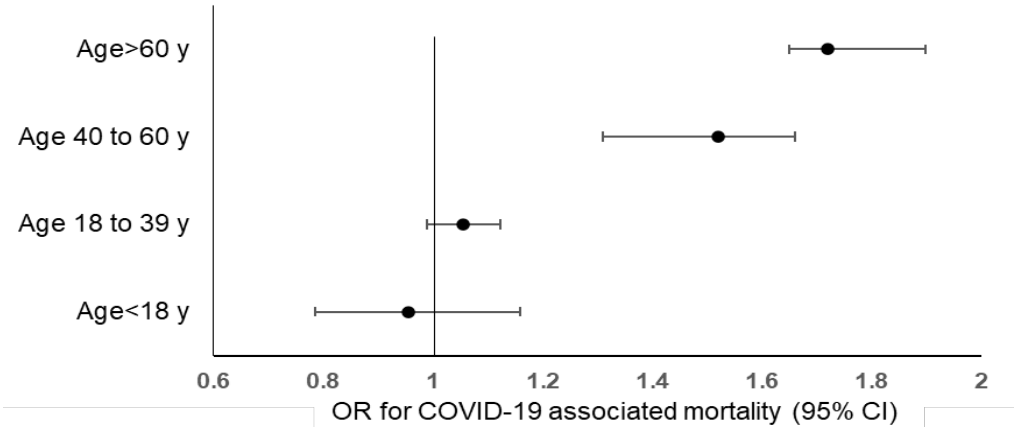

Figure 1: Association (odds ratio and 95% CI) of Age and COVID-19 mortality. OR -odds ratio, CI confidence interval

Baseline clinical characteristics detected as risk factors for COVID-19 mortality include body temperature >99^{0}F [OR 1.507 (95% CI (1.159 - 1.959)], Pulse>100 [OR, 1.085 (95% CI 1.048 - 1.123)], severely high respiratory rate (OR, 1.82 [95% CI (1.551 - 2.136)], and poor oxygen (O_2) saturation (OR, 1.252 [95% CI 1.045 - 1.499]).

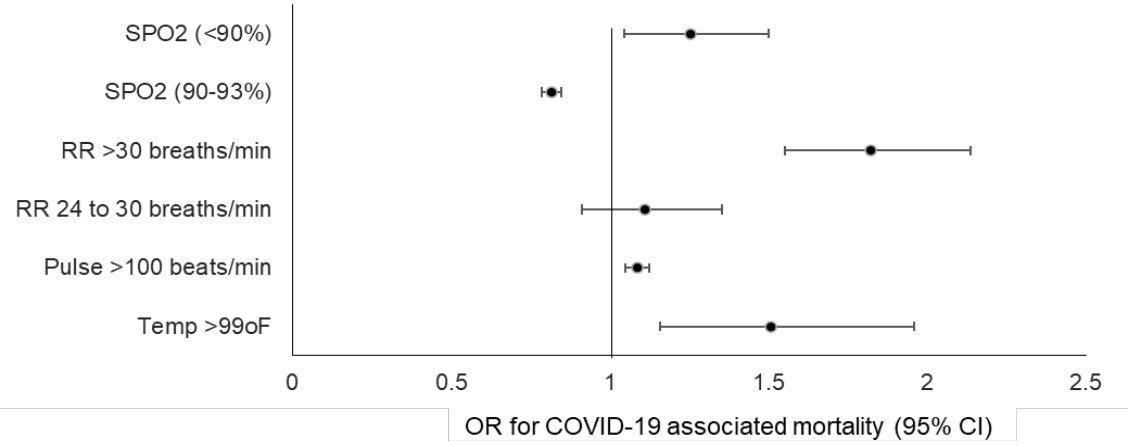

Figure 2: Association (odds ratio and 95% CI) of Clinical parameters and COVID-19 mortality. OR-odds ratio; CI confidence interval; SpO_2 oxygen saturation, RR-respiratory rate

Discussion

In this study of COVID-19 patients hospitalized in a single tertiary care centre, we report that vital indicators usually obtained during initial clinical evaluations are useful markers of COVID-19 related mortality. Logistic regression was used to describe factors associated with mortality. Logistic regression analyses showed that age, higher respiratory rate, higher body temperature and poor oxygen saturation are the predominant factors affecting mortality.

This retrospective observational study demonstrates significant associations between vitals measured at admission and COVID-19 mortality. These results are in agreement with those reported previously from various regions across the globe. [6] Several retrospective cohort and population studies have shown that advanced age in patients infected with SARS-CoV-2 is associated with higher risk of mortality. [7,8] This association could be attributed to poor immune system function and multiple comorbidities associated with advanced age. [9]

Objective signs of respiratory impact consist of oxygen saturation and respiratory rate; both are associated with evidently high risk of mortality. [10,11] Hypoxemia or oxygen saturation below 90% on admission is a strong predictor of in-hospital mortality in patients with COVID-19, also by regression analysis in our study.[12] Previous studies found that a respiratory rate >22-23 breaths per minute was associated with elevated mortality in hospitalized COVID-19 patients, while in our study rate >24 breaths per minute was found to be significantly associated with mortality. [10,13] Thus, in situations with inaccessibility to oximeters, higher respiratory rate can be used as a surrogate marker. [10]

Fever has been associated with adverse outcomes in these patients after adjusting for confounding factors. [14] Febrile illness may be an important parameter in asymptomatic patients. [14,15] This study confirms that objective measures with readily available techniques at admission can effectively indicate risk of COVID-19 associated mortality.

These findings can facilitate stratification of patients based on disease severity and rationally implement and optimize available treatment methods, especially important in pandemic times with huge resource constraints. These factors reduce the reliance on expensive imaging and biochemical assessment which often delay management of the patient.

This study has few limitations. This study is limited to a single centre restricting the applicability of our study. The current analyses were solely based on in-patient characteristics in a tertiary care facility; therefore, the results should be interpreted with caution when applying to a population at large.

Conclusion

In this retrospective observational study focusing on age and clinical parameters of confirmed COVID-19 patients in a tertiary care hospital, older age, body temperature >990F, pulse>100, high respiratory rate and poor oxygen saturation were identified as risk factors for COVID-19 mortality. Particularly, our results show that instantaneous, objective measures obtained at the time of admission, can be effective predictors of mortality. These findings may be useful to develop strategies to enhance clinical management of patients affected with COVID-19 in case of another outbreak and even in countries currently managing this viral infection.

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