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Original Article

An analysis of mortality and survival of COVID 19 patients admitted to a tertiary care hospital in Maharashtra, India

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ABSTRACT

Background: After nine months of responding to the coronavirus disease-19 (COVID-19) pandemic, the scientific fraternity is yet to unravel the mystery of those who are at most risk from mortality. Despite resistance to wear masks, the global public health response has beaten the grimmer projections of millions of deaths. The present study seeks to analyze the survival of COVID-19 patients at a tertiary care hospital and identify the risk factors of mortality.

Methods: Medical records of 1233 RT PCR confirmed COVID-19 patients admitted in a tertiary care hospital between 01 April and 30 September 2020 were retrospectively analyzed for calculating overall survival and to investigate the independent predictors of survival of COVID-19 patients.

Results: There were 72 (5.8%) deaths; which occurred in 24.9% of the elderly (age > 60yrs) people ($P < 0.001$), 76.0% in people with multiple comorbidities (having more than one co-morbidity) ($P < 0.001$), 75.6% in people with diabetes ($P < 0.001$), and 75.5% in people with hypertension ($P < 0.001$). A significantly higher risk of mortality was observed in elderly patients, patients with comorbidities, and patients requiring oxygen while admitted in the hospital.

Conclusion: Survival reflects the cure rates and is used by health professionals and policy-makers to plan and implement disease control measures. The insights provided by the study would help facilitate the identification of patients at risk and timely provision of specialized care for the prevention of adverse outcomes in the hospital setting.

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Introduction

The novel coronavirus disease 19 (COVID-19) has caused unprecedented stress on the health care system across the globe. Efforts to stratify clinical outcomes and predict survival are paramount for allocating resources and targeting interventions.[1] In India, from 30 January to 31 October 2020, there have been 82,67,623 confirmed cases of COVID-19, and more than one lac people have succumbed to the illness.[2] Health agencies across the globe have been closely monitoring the mortality of the COVID-19. China reported an overall 2.3% mortality rate among COVID-19 patients with a significantly higher mortality rate (14.8%) reported among the elderly patients (80 years or older).[3] In Italy, where more than 23% of residents were 65 or older,[4] the overall mortality rate was 5%, with 20% being elderly patients.[5,6] Overall the mortality rates so far have ranged from 0.9% in Russia to 18.3% in France.[7]

As per the recent reports, India is one of the worst affected countries in terms of the number of cases; however, in terms of case fatality, India does not figure in the list of top ten countries. In India, the survival rates vary widely between different states with Gujarat (6.2%), Madhya Pradesh (4.25), and Maharashtra (3.7%) reporting the highest mortality rates.[7] The disease continues to pose new challenges, and little is known with regard to the progression of the disease and its outcome. The exact reasons for the difference in mortality between and within the countries is still unknown, but as per the existing scientific knowledge, the difference has been postulated to be due to multiple reasons such as demographic profile, presence of comorbidities, genetic variation of the virus, etc. It is only time and research that will provide answers to this conundrum. However, as the disease continues to cause global mayhem, to face the pandemic and reduce death, it is essential to study factors that influence the risk of death from COVID-19. Survival reflects the cure rates and is a positive measure that can be used by health professionals and decision-makers to plan and implement measures for containing and combating the COVID-19 pandemic. The literature on the survival of COVID-19 patients and its prognostic factors is sparse. Hence, the present study was conducted to study survival and identify risk factors of mortality in RT PCR–confirmed COVID-19 patients admitted in a tertiary care hospital in western Maharashtra.

Materials and methods

Medical records of 1233 RT PCR–confirmed COVID-19 patients admitted in a tertiary care hospital between 01 April to 30 September 2020 were retrospectively analyzed. Data on the details of demography and clinical parameters were retrieved from the medical records section of the health department. Patients' overall survival (OS) duration was defined as the time interval between the date of diagnosis (positive test) and date of death or the date of discharge (patients were discharged after at least one negative RT PCR test), whichever was earlier. The entry point of each patient was different, and the event of interest was taken as death in the hospital. If the event had not occurred then the survival time was taken to be censored beyond the time of discharge.

Kaplan–Meier methods were used to estimate the OS by patient groups, and the log-rank test was used to compare survival curves. Factors that were found to be significantly related to survival, on univariate analysis, were considered in multivariate modelling. The Cox regression method was used to investigate the independent predictors of survival (estimating the survival function in presence of various covariates). All statistical analyses were performed using the Statistical Package for Social Science program (SPSS for Windows, version 20, SPSS, Chicago, IL, USA). $P < 0.05$ was considered to be statistically significant.

Results

The mean age of the patients was 41.63 (±17.63) years, 16.6% of cases were above the age of 60 years; 79.8% being male and 5.7% having comorbidity while on admission (Table 1). Of the 1233 patients, 72 (5.8%) patients expired and 1161 (94.16%) recovered. With respect to survival analysis, the time from

Table 1 – Patients' characteristics.

Parameter	No. of patients	%
Age		
Mean	41.63 (±17.63) Years	
Median	38.00 Years	
Range	07–86 Years	
Age groups		
<40	651	52.8
41–60	377	30.6
>60	205	16.6
Gender		
Male	984	79.8
Female	249	20.2
Comorbidity		
Present	70	5.7
Absent	1163	94.3
Distribution of comorbidity		
Hypertension	53	4.3
Diabetes mellitus	45	3.6
Multiple	50	4.1
Symptoms		
Asymptomatic	392	31.8
Symptomatic	841	68.2
Requirement of respiratory support		
Not needed	1061	86.1
Oxygen	101	8.2
NIV	59	4.8
Ventilator	12	1.0
Outcome		
Death	72	5.8
Recovered	1161	94.2
Time gap onset of symptoms to admission		
≤5 days	1022	82.9
≥6 days	211	17.1

Table 2 – 28 days overall survival.

Parameter	No. of patients			28 days overall survival	p Value
	Alive (%)	Dead (%)	Total		
Age					
<40 years	650 (99.8%)	1 (0.2%)	651	99.8	0.00
41–60 years	357 (94.7%)	20 (5.3%)	377	92.5	
> 60 years	154 (75.1%)	51 (24.9%)	205	65.9	
Gender					
Male	934 (94.9%)	50 (5.1%)	984	92.7	0.08
Female	227 (91.2%)	22 (8.8%)	249	87.8	
Comorbidity					
Present	1139 (98.2%)	21 (1.8%)	73	21.1	0.00
Absent	22 (30.1%)	51 (69.9%)	1160	97.3	
Distribution of comorbidity					
No comorbidity	1139 (98.2%)	21 (1.8%)	1160	97.3	0.00
Single comorbidity	10 (43.5%)	13 (56.5%)	23	34.7	
Multiple comorbidities	12 (24.0%)	38 (76.0%)	50	14.3	
Presence of diabetes					
Present	11 (24.4%)	34 (75.6%)	45	16.7	0.00
Absent	1150 (96.8%)	38 (3.2%)	1188	95.3	
Presence of hypertension					
Present	1148 (97.3%)	32 (2.7%)	53	16.3	0.00
Absent	13 (24.5%)	40 (75.5%)	1180	96.1	
Requirement of respiratory support					
Not needed	1045 (98.5%)	16 (1.5%)	1061	97.4	0.00
Oxygen	89 (88.1%)	12 (11.9%)	101	87.1	
NIV	26 (44.1%)	33 (55.9%)	59	35	
Ventilator	1 (8.3%)	11 (91.7%)	12	8.0	
Time gap onset of symptoms to admission					
≤5 days	970 (94.9%)	52 (5.1%)	1022	92.6	0.121
≥6 days	191 (90.5%)	20 (9.5%)	211	89.8	

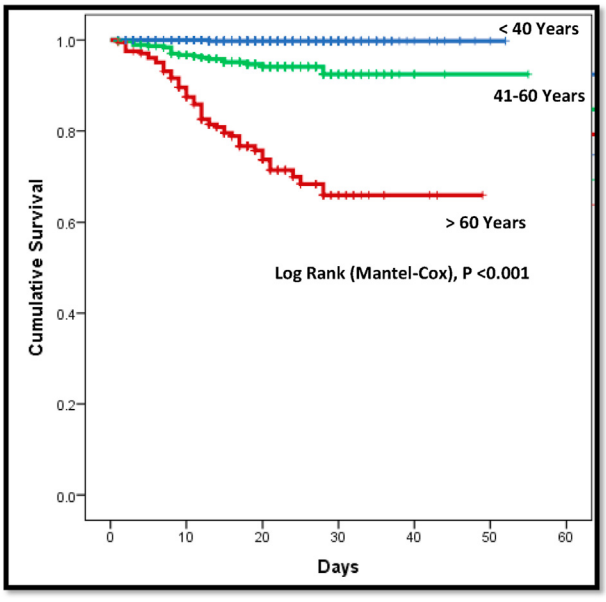

Fig. 1 – Survival as per age.

onset of symptoms until death/discharge was considered to be the study time variable. Using Kaplan–Meier survival function, the 28-day OS was found to be 91.5%. Death occurred in 24.9% of the elderly people (patients of age more than 60 years) ($P < 0.001$), 76.0% in people with multiple comorbidities (having more than one comorbidity) ($P < 0.001$), 75.6% in people with diabetes ($P < 0.001$), 75.5% in people with hypertension ($P < 0.001$). Patients requiring oxygen support irrespective of the modality of O_2 delivery had higher mortality (11.9% expired) and patients requiring mechanical ventilation had the highest mortality (91.7%, $P < 0.001$). To study whether the duration of symptoms and provision of institutional care influenced survival, the time from onset of symptom to admission in the hospital was calculated and was analyzed with reference to the survival of the COVID patients. However, no difference in outcome was observed between patients who were admitted in hospital within 05 days of onset of symptoms and those beyond 05 days ($p > 0.05$) (Table 2, Figs. 1–5).

Univariate analysis was conducted to identify factors influencing survival. Age, gender, presence of comorbidities, and requirement of oxygen were found to be significantly associated with survival. To adjust for other factors and ascertain intended prognosticators, all variables were included in the Multivariate Cox proportion regression step-down reduction model to ascertain independent prognostic factors of survival. After adjustment, a significantly higher risk of mortality was observed in elderly patients (age > 60 years) (HR 23.85, $p < 0.01$, 95% C.I. 3.09–183.89), patients with comorbidities (HR 14.71, $p < 0.01$, 95% C.I. 8.24–26.27), and

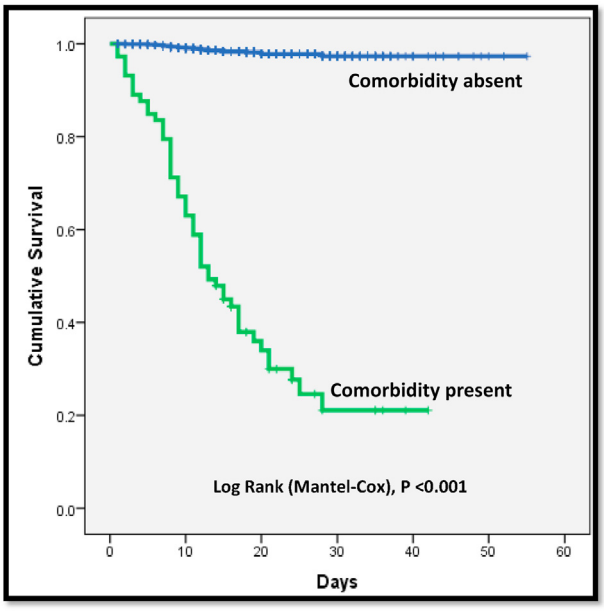

Fig. 2 – Survival as per comorbidity.

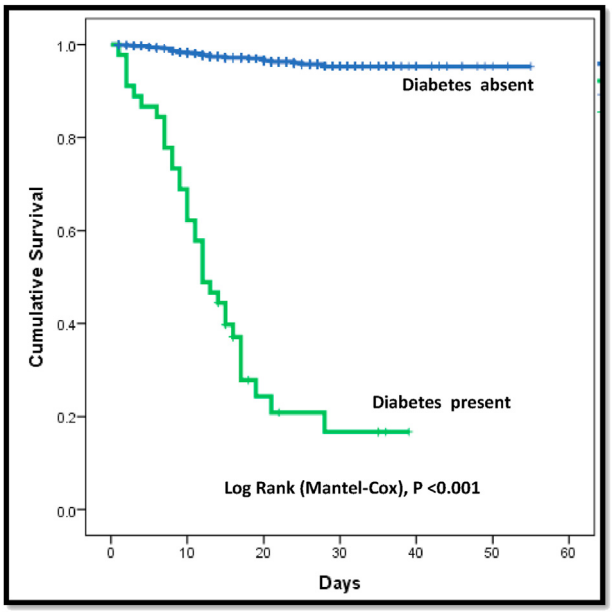

Fig. 4 – Survival as per presence/absence of diabetes.

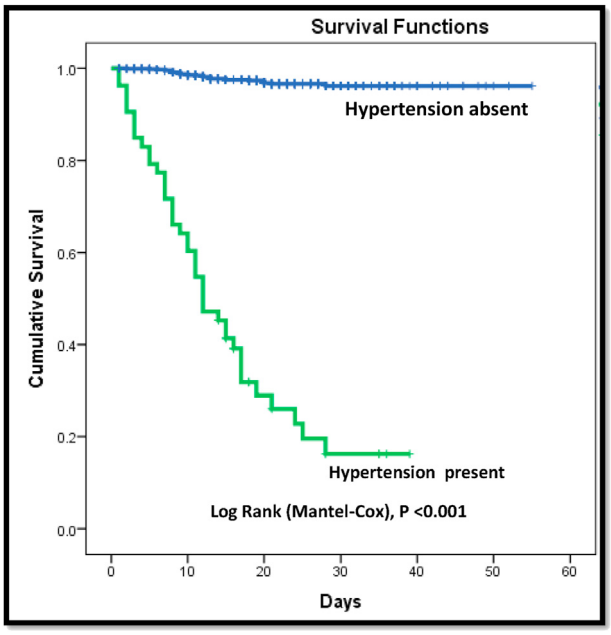

Fig. 3 – Survival as per presence/absence of hypertension.

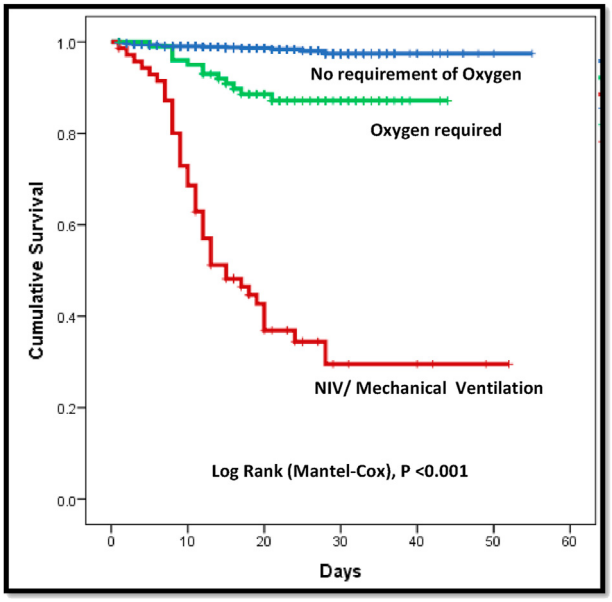

Fig. 5 – Survival as per requirement of oxygen.

patients requiring of oxygen while admitted in hospital (HR 3.72, $p < 0.01$, 95% C.I. 2.15–6.86) (Table 3).

Discussion

The state of Maharashtra had the highest number of COVID-19 cases and deaths in India till 31 October 2020.[7] Our study found that the survival of the COVID-19 patients in the hospital decreased with increasing age and patients of age more than 60 years were at higher risk of dying (HR 23.85, $p < 0.01$, 95% CI 3.09–183.89) than those in lower age groups. A study of 2070 COVID-19 patients from the northeast state of Brazil has also found that the elderly (more than 60 years) had a higher risk of dying in both the Poisson and Cox models.[8] In accordance with the Chinese Center for Disease Control, the mortality rate is largely influenced by the age of patients (>60 years), reaching 14.8% in those with >80 years.[9] Similarly, a higher risk of mortality due to COVID-19 in the elderly population has been reported by many national and international authors;[10] our study thus confirms the current epidemiology of the disease.

In our study, women were found to be at a higher risk of death than men in univariate analysis; however, after adjustment (multivariate analysis), the difference was not found to be significant. A study from Mexico had reported that men

Table 3 – Univariate and multivariate analysis of prognostic factors for overall survival in patients with oral cavity.

Parameter	Univariate		Multivariate	
	HR (95% CI)	p value	HR (95% CI)	p value
Age, >40 years	34.17 (4.58–254.66)	0.000	16.52 (2.17–125.59)	0.007[a]
Age, >60 years	174.63 (24.13–1263.87)	0.000	23.85 (3.09–183.89)	0.002[a]
Sex (female)	1.94 (1.17–3.21)	0.010	[b]	
Comorbidity (present)	52.76 (31.66–87.90)	0.000	14.71 (8.24–26.27)	0.000[a]
Requirement of respiratory support	21.00 (12.04–36.62)	0.000	3.72 (2.15–6.86)	0.000[a]
Time gap onset of symptoms to admission (>5 days)	1.50 (0.894–2.52)	0.124	[b]	

Abbreviations: HR, hazard ratio; CI, confidence interval; NS, nonsignificant.
[a] Statistically significant with $P < 0.05$.
[b] Predictors nonselected with the stepdown method.

were at higher risk of dying than women (HR 1.21, $p < 0.01$, 95% C.I. 1.09–1.35); however, this study had not adjusted for other factors.[11] Similar to our study, many researchers from various countries including India have reported no significant difference in survival between men and women.[8–10] The presence of comorbidities was found to adversely affect survival. The 28-day survival for individuals with comorbidities was found to 31.3% as compared with 95% for patients without comorbidities. Patients with single comorbidity such as diabetes or hypertension as well as with multiple comorbidities were found to have significantly lower survival than individuals with no comorbidities. Studies have reported higher circulating levels of cytokines such as interleukin-6 were found in COVID-19 patients with DM indicating the presence of an underlying proinflammatory milieu and it has been postulated as one mechanism linking DM to worse severity outcomes in COVID-19 patients.[12,13] In multivariate analysis, the presence of comorbidity (HR 14.71, $p < 0.01$, 95% CI 8.24–26.27) was found to significantly affect the survival of COIVD-19 patients. This was in line with many studies which have reported that patients with COVID-19 disease who have comorbidities are more likely to experience more severe diseases and a higher risk of mortality.[8,10,14,15] Oxygen desaturation and requirement of oxygen support in COVID-19 patients have been reported to be an indicator of disease progression and poor outcome.[16] In our study, patients requiring oxygen support were found to have higher mortality.

The present study, despite having the distinction of being one of its kind in the Indian population, is not devoid of limitations. One of the major limitations of the study is that it is based on secondary data and only factors that were available in the database have been taken into consideration for survival analysis. Hence, certain important factors such as classification of the patients as per mild, moderate, and severe at the time of admission, presence of obesity, or clinical progression of the diseases including laboratory parameters could not be studied. However, even with limitations, the results presented by the article are similar to available scientific literature and provides an insight into the epidemiology of the disease, specifically in the Indian population.

Conclusion

It has been more than a year since the first case of COVID-19 was reported in the world, but still, the disease continues to be a mystery posing new challenges to the practicing clinician and public health professionals in controlling the disease. Survival and mortality data from our study were similar to other studies conducted elsewhere. The available scientific literature indicates that the elderly and people with comorbidities have a higher risk of death and shorter survival. The present study is one of its kind in India to present mortality of COVID-19 and the survival of the patients affected by the disease. The insights provided by the study would help facilitate the identification of patients at risk and timely provision of specialized care for the prevention of adverse outcomes in a hospital setting.

Disclosure of competing interest

The authors have none to declare.

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