



STUDY OF PROGNOSTIC INDICATORS OF MORTALITY AMONG COVID-19 PATIENTS AT TERTIARY CARE CENTER IN SOLAPUR, MAHARASHTRA, INDIA

General Medicine

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ABSTRACT

COVID-19 is a viral disease affecting more than 200 countries worldwide and it present with varied clinical profile throughout the world. Without effective drugs to cure COVID-19, early identification and control of risk factors are important measures to combat COVID-19. This study was conducted to determine the prognostic indicators of mortality among COVID-19 patients at Tertiary care center in Solapur, India. This study was conducted by reviewing the case records of COVID19 patients admitted for treatment from 1st march 2021 to 29th may 2021 in a tertiary care center in Solapur, Maharashtra. The Death details were collected and were entered in MS Excel. Out of 967 COVID-19 patients, 58.79% (n=568) were men. Increasing age, male gender, patients presenting with symptoms of fever, cough, breathlessness, late presentation to hospital, comorbidities, saturation of less than 90 percent, More than 4 zone involvement on Xray and HRCT score of more than 15 on admission were identified as significantly associated with higher mortality among COVID-19 patients. Patients with older age, male gender, breathlessness, fever, cough, comorbidities need careful observation and early intervention. Public health campaigns aimed at reducing the prevalence of risk factors like diabetes, hypertension are also needed.

KEYWORDS

COVID-19, SARS CoV-2, risk factors, survival analysis, mortality

INTRODUCTION

Severe acute respiratory syndrome— related coronavirus— 2 (SARS— CoV— 2) infection emerged in Wuhan, China, and has spread rapidly worldwide.^[1] Currently COVID-19 pandemic has affected 178939856 cases and 3874879 deaths till 29th may 2020.^[2] India is currently burdened with 28881352 cases and 356740 deaths as of 29th May whereas Solapur is affected with 170366 cases and 4495 deaths.^[3]

The clinical presentation and the mortality pattern is widely varied across the countries. In countries like India with diversity, the presentation of COVID-19 is different even among different States. Thirty percent of SARS— CoV— 2 infection presents without any symptoms and usually recovers without immediate complications.^[4] Evidence shows that 80% of the COVID-19 patients present with mild to moderate disease in which symptoms such as mild upper respiratory tract illness fever, cough, myalgia, fatigue, anosmia, breathlessness and pneumonia were present.^[5] Around 20% of the COVID-19 patients present with severe acute respiratory illness and most of these severe patients succumb to death.^[5-7] Severity of COVID-19 disease among patients infected with SARS CoV 2 virus varies widely between different countries. In Italy the proportion of severe cases was 37%^[8], in China it was 13.8%^[9] and in the USA 12% of COVID-19 patients had severe cases.

In India, most people with SARS CoV-2 infections develop mild or uncomplicated illnesses.^[5] Only 14% of the patients develop the severe disease that requires hospitalization and oxygen support, and 5% require admission to an intensive care unit.^[5] The risk factors for severe COVID-19 disease and mortality need to be identified to find out who are at higher risk of having severe disease and death.

Studies in other countries have identified that older age, male gender, presence of comorbidities like diabetes, hypertension, chronic kidney disease have positively associated with severity and mortality for COVID-19.^[10-13] Literature regarding risk factors for COVID-19 mortality is very limited in the Indian setting. Without effective drugs for COVID-19, the public health interventions like identification and control of risk factors, social distancing, wearing masks, performing hand hygiene remain the mainstay of management to combat COVID-19.

For effective implementation of the above public interventions, early identification and management of risk factors for mortality due to COVID-19 is the need of the hour. With this background, this study was conducted to determine the risk factors associated with mortality among COVID-19 patients in a tertiary care hospital in Solapur, Maharashtra.

METHODS

A study was carried out by reviewing the case sheets of COVID-19 patients admitted for treatment in the tertiary care centre in Solapur. This tertiary care institution is equipped with around 300 beds and was designated as Dedicated COVID Health Centre (DCHC). Since then COVID-19 patients were given inpatient care in this institute. Standard care is being provided free of cost to COVID patients seeking care at the hospital as per the Ministry of Health and Family Welfare, Government of Maharashtra guidelines.

Each COVID-19 patient's clinical details were maintained in the case records which were collected by the study investigators. The data related to the clinical and socio-demographic details were collected and entered in MS Excel. The data collected were anonymous and confidentiality of information was maintained throughout the study. A total of 967 case records of the confirmed COVID-19 patients admitted from 1st march 2021 to 29th may 2021 were collected and analysed. Patients were followed till death from the hospital.

The variables collected from the case record and used for the analysis were age, gender, symptoms like fever, cough, breathlessness, comorbidities like diabetes, hypertension, respiratory diseases, chronic kidney disease, Oxygen saturation, NEWS score, Chest xray, HRCT finding on admission. The outcomes were classified as death of the COVID-19 patient. The continuous variable age is categorized in 10 years intervals.

Ethical considerations:

The study was conducted after the protocol was approved by the Institutional Ethics Committee and due permissions were taken from the authorities. Data were collected anonymously and confidentiality was maintained throughout the study.

RESULTS

A total of 967 COVID-19 patients were included in the study. Among them, 399 (41.26%) were women and 568 (58.73%) were men (Table No.1). All patients who presented to hospital had Symptoms of the COVID-19 i.e fever (90.24%), cough (100%), difficulty in breathing (100%), myalgia (60.9%). The average duration of stay in the hospital was 5 (3-8) days (Table No.2). Study revealed total 120 patients out of 967 were brought dead to the hospital and (n=276) 40.95 % of deaths occurred within 24 hours of admission (Table No.2). 77.46 % (n=629) of deaths occurs within 5 days of admission to hospital (Table No.2). NEWS score of more than 7 was seen in (n=763) 90.008% patients (Table No.4). 93.51 % (n=792) patients presented with severe covid 9 infection according to ICMR criteria during admission (Table No 5). (n=659) 93.51 % had oxygen saturation less than 70 percent during admission. 789 patients out of 847 (93.15 %) had chest x-ray more than 5 zones which suggest of severe condition of patient on admission (Table No 7). Total 62 patients out of 108 (57.41 %) had CT score of more than 15 on admission suggestive of severe disease on admission (Table No.8). Total 566 patients out of 847 (66.82 %) Patients have presented after 4 days of onset of symptoms to the hospital (Table 9). Co-morbidity was present in 366 (43.21%) of the COVID-19 patients presented to the hospital (Table No.3). The comorbidities with which they presented were hypertension (19.36%), diabetes (18.30%), chronic kidney disease (1.65%), cardiac illnesses (2.72%), Cerebrovascular accident (0.71%), COPD (0.47%) (Table No.3).

Our results have depicted that as the age increased, the risk of death due to COVID-19 also increases significantly. As compared to COVID-19 patients in the less than 40 years age group, the patients in the more than 40 years age group had increased risk of mortality. Male COVID-19 patients had 1.42 times increased risk of death as compared to female patients (Table No.1). COVID-19 patients who presented with breathlessness had increased risk of mortality. COVID-19 patients with comorbidities had increased risk of death as compared to patients without comorbidities. Hypertension and diabetes were the common comorbidities with which COVID-19 patients presented to the hospital which increased the risk of mortality.

Table No.1 - Age and sex wise distribution:

Age	Male	Female	Total	%
<20yrs	8	2	10	1.03%
21-30	14	16	30	3.10%
31-40	63	20	83	8.58%
41-50	102	73	175	18.10%
51-60	132	89	221	22.85%
61-70	134	118	252	26.06%
>70	115	81	196	20.27%
Total	568	399	967	100.00%

Table No 2 - Relationship between Duration of hospital stay and death

Duration	Total	%
BROUGHT DEAD	120	12.41%
< 6 hours	113	11.69%
6-24 hours	163	16.86%
1-5 days	353	36.50%
6-10 days	171	17.68%
> 10 days	47	4.86%

Table No 3 - Relationship between Comorbid condition and death(847 deaths excluding brought dead patients)

Comorbidity	Male	Female	Total	%
HTN	85	79	164	19.36%
DM	73	82	155	18.30%
IHD	11	12	23	2.72%
COPD	2	2	4	0.47%
CVA	3	3	6	0.71%
CKD	5	9	14	1.65%
Total	179	187	366	43.21%

Table No 4 - Relationship between NEWS score and mortality: (Deaths excluding brought dead patients)

NEWS SCORE (Risk grading)	No. Of patients	Percentage
1-4 (low)	6	0.7 %
5-6 (medium)	54	6.37
7 or more than 7 (high)	763	90.08 %

Table No 5 - Relationship Between Stage, Category Group (icmr) And Death (deaths Excluding Brought Dead Patients)

Category	Number of cases	%
Mild	6	0.71%
Moderate	49	5.79%
SEVERE	792	93.51%
Total	847	100.00%

Table No 6 - SPO2 on admission and COVID Deaths

Spo2	Number of patients	Percentage
30 – 40 %	202	23.85%
41 – 50 %	134	15.82%
51 – 60 %	187	22.08%
61 – 70 %	136	16.06%
71 – 80 %	136	16.06%
81 – 90 %	47	5.55%
More than 91 %	5	0.59%

Table No7 - Chest X-ray on admission and COVID Deaths

Chest X-ray	Number of patients	Percentage
3	4	0.47%
4	54	6.38%
5	399	47.11%
6	390	46.04%
Total	847	100.00%

Table No 8 - HRCT on admission and COVID Deaths

HRCT	No of Patients	Percentage
Less than 10	7	6.48%
10 and 15	39	36.11%
16 to 20	51	47.22%
more than 20	11	10.19%
Total	108	100.00%

Table no 9 - Duration of illness before admission to hospital

Days	Number of Patients	Percentage
1	55	6.49%
2	48	5.67%
3	178	21.02%
4	248	29.28%
5	230	27.15%
6	13	1.53%
7	26	3.07%
8	11	1.30%
9	5	0.59%
10	21	2.48%
>10	12	1.42%
TOTAL	847	100.00%

DISCUSSION

The results of our analysis have shown that increasing age, male gender, patients presenting with symptoms of Cough, breathlessness, presence of comorbidities like diabetes, hypertension, respiratory disease, chronic kidney disease and cardiac illness were significantly associated with mortality among COVID-19 patients.

Many other studies have evaluated clinical features and their correlation to severity and mortality^[5,6,7,8,9,10,11,13,20,21,26]. A systematic review and meta-analysis done by Galbadage et al have identified that male sex is a significant risk factor for severe disease and COVID-19 mortality.^[15,16,17] The immunological, biological, cultural and socio-behavioral aspects might have led to the unfavorable situation for the male sex.^[25] COVID 19 infection is less in female because of difference in innate immunity, steroid hormones and factors related to sex hormones. The presence of 2 XX chromosomes in females emphasizes the immune system even if one is inactive. The immune regulatory genes encoded by X chromosome in female gender causes lower viral load levels and less inflammation than in males. CD4 cells are higher in females with better immune response. In addition women generally produce higher level of antibody which remain in circulation for longer.

Our study depicted that older age increased the risk of COVID-19 mortality in the Indian population which was similar to other studies in the Mexican, Chinese populations.^[10,18,19] Age related decrease in clearance of inhaled particles in the airway, immunosenescence (a gradual decline in immune function due to aging), the change in

quantity and quality of mucins and protective glycoproteins found in mucosal barriers, presence of comorbidities might be the reasons for the increased risk of COVID-19 mortality among older individuals.^[14,26] Older age is more associated with co morbid illness like DM, Hypertension and IHD which contribute to higher mortality in elderly vulnerability to an infection in the elderly is usually explained by immunosenescence.

Among the various symptoms for COVID-19 disease, our study identified that the presence of fever, cough and breathlessness are significantly associated with COVID-19 mortality. Other studies done in China and Nigeria also showed that these symptoms are associated with severe disease and mortality due to COVID-19.^[20,21] In the study done in Nigeria, breathlessness increased the risk of mortality by 19 times (OR=19.26 95% CI 10.95-33.88) which is similar to our study.^[21] The presence of any comorbidity increased the risk of death by 4 times in our study which is similar to other studies.^[22,23] The poorer prognosis of people with diabetes is likely consequence of syndromic nature of the disease: hyperglycemia, older age and its association with Hypertension, obesity and cardiovascular diseases^[27]. The other reason is the use of Glucocorticoids in severe acute respiratory syndrome which worsens insulin resistance, sustains gluconeogenesis, worsens glycemic control and causes marked hyperglycemia. Hence the people with diabetes with COVID 19 are at a greater risk of worse prognosis and mortality. With diabetes and hypertension are the most common co-morbidities among COVID-19 patients in India, ACE2 mediated pathway, abnormal blood glucose levels mediated disruption of immunity might be the reasons for increased mortality among COVID-19 patients.^[22,23,27] The presence of other co-morbidities like obesity in diabetes and hypertension might also be contributing to the mortality by altered immune responses due to low vitamin D levels and adiponectin levels and high leptin levels.^[27] 4 patients in our study had COPD, **COPD patients have increased risk of severe pneumonia and poor outcomes when they develop COVID-19. This may be related to poor underlying lung reserves or increased expression of ACE-2 receptor in small airways**^[32]. 6 patients in the study had CVA. An analytical study revealed a pooled incidence of 1.7% for ischemic CVA in the setting of COVID-19 infection, with a mortality rate of 29.2% amongst the COVID-19 patients who are suffering ischemic CVA^[33].

Our analysis also identified 6 times increased risk of COVID-19 mortality among CKD patients. SARS-CoV-2 might affect the kidney through the ACE2-dependent pathway, causing acute renal impairment and death^[24]

NEWS may make a useful contribution to disease surveillance in care homes during the COVID-19 pandemic. Oxygen saturation, respiratory rate and temperature could be prioritised as they appear to signal rise in mortality. Oxygen saturation below 90% on admission is a strong predictor of in-hospital mortality in patients with COVID-19^[28]. In settings with limited resources, efforts to reduce mortality in COVID-19 should focus on early identification of hypoxemia and timely access to hospital care.

Involvement of predominantly 4 or more zones on frontal chest radiograph can be used as predictive prognostic indicator of poorer outcome in COVID-19 patients^[29]. Proposed CXR pulmonary severity score in COVID-19 showed moderate to almost perfect interobserver agreement and significant correlations with clinical parameters, potentially furthering CXR integration in patients' stratification. Chest CT findings were worsening in patients who died of COVID 19 with moderate positive correlation between CT Severity score^[30]. The study showed that the average CT scores were significantly increased on admission and further increase in follow up. Average CT score was 14.53. The CT score correlated with severity of disease as indicated by requirement of intubation and ventilation. Excess mortality occurred in patients admitted to the ICU within a week after COVID-19 onset^[31].

CONCLUSIONS

To conclude, increasing age, male gender, late presentation to hospital, presenting symptoms like fever, cough, breathlessness, presence of comorbidities, saturation of less than 90 percent, Xrays of more than 4 zone involvement on admission, HRCT more than 15 on admission were identified as the significant risk factors for mortality due to COVID-19. Early identification of these risk factors and appropriate treatment is important to prevent death among COVID-19 patients. It is recommended that COVID-19 patients with these risk factors can be

given appropriate inpatient care instead of domiciliary management to prevent fatal outcomes among high-risk patients. We also need to implement public health campaigns aimed at reducing the prevalence of risk factors like diabetes, hypertension and other comorbidities. Long term consequences of COVID-19 disease need to be assessed with longitudinal studies with longer follow up period.

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