International Journal of Community Medicine and Public Health
Dhikale PT et al. Int J Community Med Public Health. 2021 Jun;8(6):3079-3083
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20212019

Original Research Article

Predictors for mortality of inpatients of COVID-19 in Mumbai

Prasad T. Dhikale[1], Smita S. Chavhan[1]*, Balkrishna B. Adsul[2], Kirti V. Kinge[1], Chinmay N. Gokhale[1], Aniket R. Ingale[1]

[1]Department of Community Medicine, HBTMC and Dr RNCH, Mumbai, Maharashtra, India
[2]Department of Community Medicine, LTMGH and MC, Sion, Mumbai, Maharashtra, India

Received: 22 April 2021
Accepted: 13 May 2021

***Correspondence:**
Dr. Smita S. Chavhan,
E-mail: drsmita1409@gmail.com

ABSTRACT

Background: The estimation of risk factors for death can help in modifying the screening, treatment strategy and saving valuable lives. The published data about this topic from India is scarce. We aim to explore the risk factors of in-hospital deaths for COVID-19 patients.
Methods: This was a hospital-based cross-sectional study. All COVID-19 patients positive on reverse transcriptase–polymerase chain reaction (RTPCR) test who were admitted in this dedicated COVID hospital (DCH) in April to July 2020 and with definite outcome (death or discharge) till end of September 2020 were included in this study. To explore the risk factors associated with in-hospital death univariate and multivariate logistic regression models were used.
Results: Of the 6195 patients, 450 (7.26%) died. Age 40-60 years [AOR (CI)=4.53 (2.71-7.58)], age >60 years [AOR (CI)=17.42 (10.55-28.75)], suffering from diabetes mellitus [AOR (CI)=2.08 (1.66-2.6)], cardiovascular diseases [AOR (CI)=1.57 (1.14-2.17)], hypertension [AOR (CI)=1.43 (1.14-1.8)], chronic kidney diseases [AOR (CI)=2.78(2.02-3.82)] were found to be significant predictors of death after adjusting for potential confounders.
Conclusions: Age >40 years, diabetes mellitus, cardiovascular diseases, hypertension, chronic kidney diseases are the independent predictors for mortality in COVID-19. These high risk groups should be given special attention for screening and treatment.

Keywords: COVID-19, Mortality, Comorbidities, Tertiary care hospital

INTRODUCTION

The pandemic of coronavirus disease 2019 (COVID-19) has spread rapidly across the world causing increased mortality and hardships. On 19 April 2021 India has 10.7% of worlds cases and mortality rate of 1.19%.[1] To ensure optimal utilization of available resources and appropriate care to all the COVID-19 patients the COVID dedicated facilities were divided into three types namely COVID care center (CCC), dedicated COVID health centre (DCHC), dedicated COVID hospital (DCH).[2] COVID-19 has a broad spectrum of clinical manifestations ranging from asymptomatic cases to death. The accurate prediction of mortality in COVID-19 and the identification of contributing factors would allow for targeted strategies in patients with the highest risk of death. It can help in modifying the screening, treatment strategy and saving valuable lives. The published studies regarding the association of comorbidities to mortality from India are scarce.

Objectives of the study were to explore the risk factors of in-hospital deaths for COVID-19 patients.

METHODS

Study setting

This study was done in a large dedicated COVID hospital in Mumbai.

Study design and population

This was a hospital-based cross-sectional study. All COVID-19 patients positive on reverse transcriptase–polymerase chain reaction (RTPCR) test of nasopharyngeal or/and oropharyngeal samples who were admitted in this DCH from April to July 2020 and with definite outcome (death or discharge) till end of September 2020 were included in this study. Suspected cases of COVID-19 whose RTPCR never came positive were excluded. The information was collected in a predesigned proforma which included socio-demographic data, duration of stay, comorbidities, outcome, etc. by trained staff. Permission of institute ethics committee (IEC) was taken. Full confidentiality of respondent's information was maintained and information was used only for research purpose.

Statistical analysis

Data entry was done by using Microsoft excel version 2010 and statistical analysis was done by using IBM statistical package for the social sciences (SPSS) statistics for windows, version 22. To explore the risk factors associated with in-hospital death univariate and multivariate logistic regression models (backward LR method) were used. As age category (0-20) years was having only one event it was excluded from final model. The multiple coefficients of determination (R^2) was used as the goodness-of-fit statistic for the model. The level of significance was fixed at 0.05.

RESULTS

The 6195 COVID-19 patients who were admitted in this DCH from April to July 2020 and with definite outcome (death or discharge) till end of September 2020 were included in this study. This paper describes the socio-demographic and clinical profile of these 6195 patients. The age (mean±SD) of the patients was 46.44±17.1 years (range: 0.1-98 years) and majority 4147 (66.9%) were males. Of 6195 patients, 450 (7.26%) died. The duration of stay (mean±SD) was 12.74±8.22 days (range: 0-84 days). The duration from admission to death (mean±SD) was 10.4±10.42 days and for survivors the duration of hospital stay (mean±SD) was 12.93±7.99 days and the difference was statistically significant (p<0.001). Total 2303 (37.17%) patients had one or more morbidities. Total 952 (15.36%) patients required intensive care unit (ICU) support.

As seen in the Table 1, in univariate analysis more patients in the deceased group had diabetes (52.4% versus 18.9%; p<0.001), hypertension (54.9% versus 21.4%; p<0.001) and cerebrovascular or cardiovascular (CVD) diseases (14.9% versus 3.7%; p<0.001), chronic kidney diseases (CKD) (15.6% versus 4.2%; p<0.001), chronic obstructive pulmonary diseases (COPD) (1.3% versus 0.1%, p<0.001), hypothyroidism (4.4% versus 2.6%; p=0.03) and were middle aged (40-60 years) (38.9% versus 34.73%, p<0.001), elderly (>60 years) (60.9% versus 18.2%, p<0.001). All above differences were found to be statistically significant.There was no significant difference in the prevalence of asthma, cancer and history of tuberculosis between the two groups (p>0.05).

Multivariate regression analysis (Table 1) showed that age group of 41–60 years and ≥60 years, CVD, CKD, hypertension, diabetes mellitus were independent predictors of mortality. The Nagelkerke pseudo-R^2 value for the final model was 23.5%. The patients >60 years of age were at 17.42 times (CI: 10.55-28.75) higher risk, patients (41-60 years) of age were at 4.53 times (CI: 2.71-7.58) higher risk of death as compared to the age group 21-40 years.

Table 1: Univariate and multivariate analysis of determinants of mortality of COVID-19 inpatients.

Characteristics	Total (%)	Deceased (%)	Survivors (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age (years)					
0-20	279 (4.5)	1 (0.2)	278 (4.8)	1 (reference)	
21-40	2186 (35.3)	19 (4.2)	2167 (37.7)	2.44 (0.32- 18.28)	1 (reference)
41-60	2411 (38.9)	156 (34.7)	2255 (39.3)	19.25 (2.69-138) *	4.53 (2.71-7.58) *
>60	1319 (21.3)	274 (60.9)	1045 (18.2)	72.89 (10.2-521) *	17.42 (10.55-28.75) *
Sex					
Male	4147 (66.9)	317 (70.4)	3830 (66.7)	1.19 (0.96-1.47)	
Female	2048 (33.1)	133 (29.6)	1915 (33.3)	1 (reference)	
Co-morbidities					
Diabetes mellitus	1323 (21.4)	236 (52.4)	1087 (18.9)	4.73 (3.88-5.75) *	2.08 (1.66-2.6) *
Hypertension	1477 (23.8)	247 (54.9)	1230 (21.4)	4.47 (3.67-5.43) *	1.43 (1.14-1.8) *
CVD	281 (4.5)	68 (15.1)	213 (3.7)	4.55 (3.39-6.11) *	1.57 (1.14-2.17) *
CKD	314 (5.1)	70 (15.6)	244 (4.2)	4.15 (3.12-5.52) *	2.78 (2.02-3.82) *
COPD	14 (0.2)	6 (1.3)	8 (0.1)	9.69 (3.35-28) *	3..46 (0.99-12.11)
Asthma	79 (1.3)	6 (1.3)	73 (1.3)	0.98 (0.48- 2.03)	
H/o TB	57 (0.9)	3 (0.7)	54 (0.9)	1.41 (0.44-4.54)	
Hypothyroidism	169 (2.7)	20 (4.4)	149 (2.6)	1.75 (1.08-2.81)*	

Continued.

Characteristics	Total (%)	Deceased (%)	Survivors (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Cancer	23 (0.4)	4 (0.9)	19 (0.3)	2.70 (0.92-7.98)	
Total	6195	450	5745		

*Statistically significant (p≤0.05), @column percentage, OR: odds ratio, CI: confidence interval

Also suffering from CKD [AOR (CI)=2.78(2.02-3.82)], diabetes mellitus [AOR (CI)=2.08(1.66-2.6)], CVD [AOR (CI)=1.57 (1.14-2.17)], Hypertension [AOR (CI)=1.43 (1.14-1.8)] were found to be the significant predictors of death after adjusting for potential confounders.

DISCUSSION

The case fatality rate (CFR) in our study was 7.26% which is more than CFR of India (1.19%), Maharashtra (1.58%), and Mumbai (2.13%) because many severe cases were admitted in this DCH.[1] Also we have included only those patients with definite outcomes while there are many active patients for India, Maharashtra and Mumbai's CFR.[1] Variations in CFR can be due to time lags, differing quality of care or interventions being introduced at different stages of the illness, profile of patients (for example their age, sex, ethnicity and underlying comorbidities), case definitions, testing strategies.[4] In a hospital based study in Jaipur CFR was 2.87% as 75.7% of their cases were asymptomatic.[5] Many hospitals treating COVID-19 patients had much higher case fatality rate like DCH in Pune 29%, in hospitals in United States of America (USA) 8.2% and in China 28.3%.[6-8] The mean age of patients in Pune DCH was similar to our study and comorbidity percentage differed for some diseases.[6] In another study in Pune DCH the CFR was 11.9%.[9] In the study in USA and China the mean age was more and comorbidity percentage differed from our study.[7,8] Coordinated teamwork from the clinicians, administration and support staff of Seven Hills DCH along with proper diet and psychiatric counselling for COVID-19 patients can be the reasons for low CFR at Seven Hills DCH.[3]

In our study the mortality rate was more in age >40 years. Early Indian data suggested age >50-60 is showing mortality from states like Maharashtra unlike global 65 years of age.[9] Many studies conclude morality is more in elderly.[6-16] There was some male preponderance in the number of inpatients, but there was no significant difference between the mortality rate of males and females. There were similar findings in some studies.[5,7,8,10,12] In our study diabetics had higher risk of dying than non-diabetics, some other studies had similar findings.[6-8,15-22] A study in China did not find such association. It can be due to smaller sample size.[12]

In our study patients suffering from hypertension and cardiovascular diseases had significantly increased mortality. Some studies had similar findings.[6,7,15,16,20,22-26] In our study patients with CKD had higher risk of dying than patients not having CKD. There were similar findings in the studies in Pune and China.[6,27]

In our study there was no significant difference in mortality rate in COVID-19 patients with reference to suffering from asthma, cancer or history of tuberculosis. A large mortality model prediction study in USA had similar findings.[7] The proportion of patients suffering from COPD was much higher in deceased group than in survivors but the difference was not statistically significant in multivariable analysis.

A study by Du et al had similar findings but a large case series of patients from China showed higher case fatality rate in patients suffering from chronic respiratory disease and cancers.[12,14] The difference can be due to different types of cancers and chronic respiratory diseases.

The population groups at high-risk of mortality i.e. age >40 years, diabetes mellitus, cardiovascular diseases, hypertension, chronic kidney diseases should be considered as priority groups for receiving the COVID 19 vaccines. The clinical management protocol: COVID-19 guidelines by Government of India includes above predictors in their risk-factors for sever diseases along with chronic lung disease and cancer but in our study we did not find significant association between mortality due to COVID-19 and chronic lung disease or cancer.[28] The high risk groups should be given special attention during screening and treatment so as to prevent mortality.

This is a hospital based study and will differ from the situation in community. Obesity, history of alcohol, tobacco, duration of diabetes and hypertension was not assessed in our study.

CONCLUSION

Age >40 years, diabetes mellitus, cardiovascular diseases, hypertension, chronic kidney diseases are the independent predictors for mortality in COVID-19. These high risk groups should be given special attention during screening and treatment so as to prevent mortality.

ACKNOWLEDGEMENTS

Authors would like to thank the contributions made by all members of administrative team, the data handling team and all others functioning behind the curtains at this dedicated COVID-19 hospital in these tough and testing times of the COVID-19 pandemic.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Report of COVID-19 cases. Medical Education and Drugs Department. 2021.
2. Ministry of Health & Family Welfare Directorate General of Health Services EMR Division. Guidance document on appropriate management of suspect/confirmed cases of COVID-19. Available at: https://www.mohfw.gov.in/pdf/FinalGuidanceonMangaementofCovidcasesversion2.pdf. Accessed on 15 January 2021.
3. Kumbhar M, Chavhan S, Adsul B. Seven Hills Dedicated Covid Hospital, Mumbai. Municipal Corporation of Greater Mumbai. 2020.
4. World Health Organization. Estimating mortality from COVID-19. Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-Sci-Brief-Mortality-2020.1. Accessed on 15 January 2021.
5. Bhandari S, Singh A, Sharma R, Rankawat G, Banerjee S, Gupta V, Dube A, Kakkar S, Sharma S, Keswani P, Agrawal A. Characteristics, Treatment Outcomes and Role of Hydroxychloroquine among 522 COVID-19 hospitalized patients in Jaipur City: An Epidemio-Clinical Study. J Assoc Physicians India. 2020:13-9.
6. Tambe MP, Parande MA, Tapare VS, BorlePS, Lakde RN, Shelke SC, BJMC COVID Epidemiology group. Anepidemiological study of laboratory confirmed COVID-19 cases admittedin a tertiary care hospital of Pune, Maharashtra. Indian J Public Health. 2020;64:183-7.
7. Yadaw AS, Li YC, Bose S, Iyengar R, Bunyavanich S, Pandey G. Clinical features of COVID-19 mortality: development and validation of a clinical prediction model. Lancet Digi Health. 2020;2(10):516-25.
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, Guan L. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The Lancet. 2020.
9. Kansara N, Nandapurkar AB, Maniyar R, Yadav AK. Prediction of mortality by age and multi-morbidities among confirmed COVID-19 patients: Secondary analysis of surveillance data in Pune, Maharashtra, India. Indian J Public Health. 2021;65:64-6.
10. Joshi SR. Indian COVID-19 Risk Score, Comorbidities and Mortality. J Assoc Phys India. 2020;68:11.
11. Mishra V, Burma AD, Das SK, Parivallal MB, Amudhan S, Rao GN. COVID-19 Hospitalized Patients in Karnataka: Survival and Stay Characteristics. Indian J Public Health. 2020;64:221-4.
12. Du RH, Liang LR, Yang CQ, Wang W, Cao TZ, Li M, Guo GY, Du J, Zheng CL, Zhu Q, Hu M. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. Eur Respir J. 2020;55(5).
13. Porcheddu R, Serra C, Kelvin D, Kelvin N, Rubino S. Similarity in case fatality rates (CFR) of COVID-19/SARS-COV-2 in Italy and China. The Journal of Infection in Developing Countries. 2020;14(2):125-8.
14. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239-42.
15. Wortham JM. Characteristics of persons who died with COVID-19—United States, February 12–May 18, 2020. MMWR. Morbid Mortal Weekly Rep. 2020;69.
16. Majeed J, Ajmera P, Goyal RK. Delineating clinical characteristics and comorbidities among 206 COVID-19 deceased patients in India: Emerging significance of renin angiotensin system derangement. Diabet Res Clin Pract. 2020;167:108349.
17. Orioli L, Hermans MP, Thissen JP, Maiter D, Vandeleene B, Yombi JC. COVID-19 in diabetic patients: related risks and specifics of management. Annal Endocrinol. 2020.
18. Hussain A, Bhowmik B, do Vale Moreira NC. COVID-19 and diabetes: Knowledge in progress. Diabet Res Clin Pract. 2020:108142.
19. Huang I, Lim MA, Pranata R. Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia–a systematic review, meta-analysis, and meta-regression. Diabet Metab Syndr. 2020.
20. Espinosa OA, Zanetti ADS, Antunes EF, Longhi FG, Matos TA, Battaglini PF. Prevalence of comorbidities in patients and mortality cases affected by SARS-CoV2: a systematic review and meta-analysis. Rev Inst Med Trop Sao Paulo. 2020;62:43.
21. Singh AK, Misra A. Impact of COVID-19 and comorbidities on health and economics: Focus on developing countries and India. Diabet Metab Syndr. 2020;14(6):1625-30.
22. Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, Liu XQ, Chen RC, Tang CL, Wang T, Ou CQ. Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis. Eur Respir J. 2020;55(5).
23. Kunal S, Gupta K, Sharma SM, Pathak V, Mittal S, Tarke C. Cardiovascular system and COVID-19: perspectives from a developing country. Monaldi Arch Chest Dis. 2020;90(2).
24. Mehra MR, Desai SS, Kuy S, Henry TD, Patel AN. Cardiovascular disease, drug therapy, and mortality in COVID-19. N Engl J Med. 2020.
25. Singh AK, Gupta R, Misra A. Comorbidities in COVID-19: Outcomes in hypertensive cohort and controversies with renin angiotensin system blockers. Diabetes Metab Syndr. 2020;14(4):283-7.
26. Dan S, Pant M, Upadhyay SK. The Case Fatality Rate in COVID-19 Patients With Cardiovascular Disease:

Global Health Challenge and Paradigm in the Current Pandemic. Curr Pharmacol Rep. 2020:1-10.
27. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, Li J, Yao Y, Ge S, Xu G. Kidney disease is Aassociated with in-hospital death of patients with COVID-19. Kidney Int. 2020.
28. Ministry of Health and Family Welfare, Government of India. Directorate General of Health Services (EMR Division) CLINICAL MANAGEMENT PROTOCOL: COVID-19. Available at https://www.mohfw.gov.in/pdf/ClinicalManagementProtocolforCOVID19.pdf. Accessed on 15 January 2021.

Cite this article as: Dhikale PT, Chavhan SS, Adsul BB, Kinge KV, Gokhale CN, Ingale AR. Predictors for mortality of inpatients of COVID-19 in Mumbai. Int J Community Med Public Health 2021;8:3079-83.