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Mortality Pattern of Hospitalised Patients during COVID-19: A Two-Year Retrospective Study in the Tertiary Care Centre in Western Maharashtra

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ABSTRACT

Introduction: The pattern of mortality is a key indicator of the consequent health effects. Globally, medical certificates of cause of death and coding of their cause by a qualified physician based on the International Classification of Diseases (ICD) used to collect epidemiological statistics.
Objectives: The study tries to analyse the mortality pattern of in-hospitalized patients and to interpret presence of associated comorbid risk factors resulting in progression and death due to COVID-19.
Material and Methods: The present retrospective study was undertaken in the tertiary care centre in Western Maharashtra between 01 January 2019 to 01 January 2021. The study was done using MCCD documents and ICD-10 to observe the pattern of mortality of in-hospital patients and to analyse the association of comorbid risk factors with the COVID-19 deaths.
Results: The total number 1210 of deaths in this study included, 66.1% male and 33.9% female. The most vulnerable age group was between 61-80 years. The maximum deaths found in Medicine ICU followed by Surgery ICU and COVID ICU/HDU between the timings of 2PM-8PM while their duration of hospital stay was less than 15 days. The major portion of death were occurred due to diseases of Circulatory System. The patients who died due to COVID-19, mostly with hypertension and diabetes were the underlying comorbidities, as the significant risk factor for deaths (OR= 7.87, 95% CI= 3.47–17.87, χ^2 = 62.78, $P < 0.005$).
Conclusions: The present study agreed with the various studies from India and abroad about diseases of circulatory system is the leading cause of death worldwide and the patients with underlying morbid conditions are more prone for COVID-19 deaths.

Keywords: Mortality, MCCD, ICD-10, COVID-19

INTRODUCTION

The life expectancy in India has increased from 49.7 years in 1970-75 to 68.7 years in 2012-16 as per the National Health Profile 2019.[(1)] Due to the consequence of economic and social change, India is undergoing a rapid epidemiological transition[(2)] where pattern of mortality occur with demographic transition is a change in the distribution of deaths. The cardiovascular diseases are the leading cause of disease burden and deaths globally.[(3)]

A medical person attending the deceased in his/her last illness should fill in the standard format of the certificate prescribed by WHO form No. 4 for institutional deaths/ 4A for non-institutional deaths. Completeness and accuracy with which the certificate of cause of deaths is filled by the attending physician are of prime importance in building the base of

cause of death statistics.[4] The Medical Certification of Cause of Death (MCCD) is essential for better health planning and management of programme for welfare of people. It is also useful to know the impact of health services, to evaluate health indicators and to understand the trend of changing mortality pattern of various diseases as well as to find out the magnitude of newly emerged diseases like COVID-19. Registrar General of India is the highest official who compiles the information received from Registrars & Sub-registrars of Births and Deaths at district level, Municipal Corporations and Municipalities of towns and Cantonment Boards of Military Cantonments.[5] The legal provisions for submission of MCCD to the local registrar is obligatory under section 10(2) and 10(3) Registration of Births and Deaths Act, 1969 and also under the Rule No. 7 of "Maharashtra Registration of Births and Deaths Rules, 2000".[4]

Registration of all deaths with certification and coding of their cause by a qualified physician based on the International Classification of Diseases (ICD) and related health problems is the preferred standard for generating cause of death statistics. Therefore, the purpose of the ICD tenth revision is to permit systematic recording, analysis, interpretation and comparison of morbidity and mortality data.[6] In-hospital patient mortality is one of the quality measures that can reflect both improvements in health care and patterns in mortality. Studies also help researchers and policymakers to assess the impact of health care quality efforts. Moreover, to respond effectively to changing epidemiological profiles.[7] The 2019 novel coronavirus (SARS-cov2) or COVID-19 causing mild disease in many but the course of disease may be severe leads to death in those with comorbid conditions.[8–11] Therefore, this study tries to analyse the mortality pattern of hospitalised patients and to interpret presence of associated comorbid risk factors resulting in progression and death due to COVID-19.

MATERIALS & METHODS

A retrospective observational study on mortality pattern of hospitalised patients using MCCD documents were analysed and also explored the association of co-morbidities with COVID-19 deaths in the tertiary care centre in Western Maharashtra. A total number of 1210 cases involving between 01 January 2019 to 01 January 2021 were included in the study. Necessary permission was taken prior to the study. For the purpose of this study, MCCD was defined as an important tool of obtaining authentic and scientific information regarding causes of mortality. All the MCCD documents including natural cause of death during the above- mentioned period were included in the study. The unnatural deaths and cases where MCCD incomplete or wrongly filled were excluded from this study. There was a detailed proforma prepared to record the epidemiological data, details of cause of death, co-morbidities etc. and the observations were thereafter statistically analysed. MCCD data collected from the record office present in statistics section of the hospital and analysed according to the International Classification of Diseases-10 (ICD-10). The study comprises of age & gender wise distribution, time of death, duration of hospital stay, department wise mortality, mortality pattern according to ICD-10 and association of comorbidities in relation to COVID-19. MCCD documents were referred for collection of information and also cross checked. Extreme care was taken to ensure the confidentiality of all the data. The data was analysed by using Microsoft office excel and ICD-10 was referred for identification of mortality in the present study.

RESULT

In the study period from 01 January 2019 to 01 January 2021, a total number of in-patient department admissions of this tertiary care centre were 33,165 of which the number of deaths was 1210. The mortality rate per 1000 admissions in year

2019 was 26 and raised in year 2020 to 53. **[Table 1]**.

Table 1: Mortality Rate per 1000 Admissions

Variables	2019	2020	Total
Total In-Patient Admissions	20,277	12,888	**33,165**
No. of Deaths	527	683	**1210**
Mortality Rate per 1000	26	53	**36.5**

Out of these 1210 mortality cases, 800 were male patients (66.1%) and 410 were female (33.9%). Most deaths are seen in males than females during both the years. The highest number of mortalities were recorded in the age group of 61-80 years during both the years in 2019 (11.4%, n=60) and 2020 (12.7% n=87) respectively whereas, the lowest number were noted in the age group 6-15 years of age in 2019 (3%, n=16) and 2020 (1.5%, n=10) respectively. Maximum mortality was in Medicine ICU (56.9%, n=688) followed by Surgery ICU (11.4%, n=138) and COVID ICU/HDU (10.5%, n=127). When the time of death was taken into consideration, large number of mortality cases were in 2019 (41%, n=216) and 2020 (46.7%, n=319) reported to occur between 2PM-8PM whereas, small number of mortality cases in 2019 (27.3%, n=144) and 2020 (22.7%, n=155) were between 8PM-8AM and the maximum duration of hospital stay was less than 15 days found during both in year 2019 (63.2%, n=333) and in year 2020 (57%, n=389) respectively [Table 2].

Table 2: Mortality Distribution of Deceased Patients

Gender wise Distribution	No. of Cases (2019) (%)	No. of Cases (2020) (%)	Total (%)
Male	345 (65.5)	455 (66.6)	800 (66.1)
Female	182 (34.5)	228 (33.4)	410 (33.9)
Age wise Distribution			
<1 year	45 (8.5)	51 (7.5)	96 (7.9)
1-5 year	24 (4.6)	23 (3.4)	47 (3.9)
6-15 year	16 (3)	10 (1.5)	26 (2.1)
16-45 year	60 (11.4)	87 (12.7)	147 (12.1)
46-60 year	106 (20.1)	168 (24.6)	274 (22.6)
61-80 year	231 (43.8)	277 (40.6)	508 (42)
>80 year	45 (8.5)	67 (9.8)	112 (9.3)
In-Patient Dept wise Mortality			
Medicine ICU	328 (62.2)	360 (52.7)	688 (56.9)
COVID ICU/HDU	0 (0)	127 (18.6)	127 (10.5)
Paediatrics/Neonatal ICU	40 (7.6)	27 (4)	67 (5.5)
Surgery ICU	76 (14.4)	62 (9.1)	138 (11.4)
OBGY	44 (8.3)	40 (5.9)	84 (6.9)
Accident & Emergency	35 (6.6)	62 (9.1)	97 (8)
Burns Centre	4 (0.8)	5 (0.7)	9 (0.7)
Duration of Hospital Stay			
<1 day	98 (18.6)	168 (24.6)	266 (36.8)
1 – 15 days	333 (63.2)	389 (57)	722 (59.7)
15 – 30 days	41 (7.8)	69 (10.1)	110 (9.1)
>30 days	55 (10.4)	57 (8.3)	112 (9.3)
Time of Death			
8AM – 2PM	167 (31.7)	209 (30.6)	376 (31.1)
2PM – 8PM	216 (41)	319 (46.7)	535 (44.2)
8PM – 8AM	144 (27.3)	155 (22.7)	299 (24.7)

The cause of death of patients was classified according to the International Classification of Diseases-10 (ICD 10), the major portion of death were occurred due to diseases of Circulatory System: ICD Chapter IX (19.1%, n=231) and the next leading cause was Neoplasms: ICD Chapter II (15.9%, n=192) than followed by COVID-19: ICD Chapter XX Codes of Special Purposes (10.5%, n=127) [Figure 1].

Out of the 127 COVID-19 cases admitted, 78 cases died giving a case fatality rate of 61.4%, while the remaining 49 cases succumbed due to consequences of other causes having alleged history of recovery from COVID-19 infection. Out of 127 patients [Table 3], 45 (35.4%) had no history of any comorbidity while 82 (64.6%) reported one or the other comorbidity; hypertension being the most common one, followed by diabetes mellitus

[Figure 2]. Out of 78 patients who died due to COVID-19, comorbidity was one of the significant risk factor for death (Odds Ratio [OR] = 7.87, 95% Confidence Interval [CI] = 3.47 – 17.87, Chi-Square [χ^2]=62.78, P < 0.005). The Odds of carrying the comorbidity were 7.87 times higher in those with COVID-19 deaths, compared with those recovered from the COVID-19 infection. The calculated chi-square is greater than the chi-square probabilities called as a critical chi-square test therefore, we reject the null hypothesis and accept the alternate hypothesis which states that there is a significant relation between the Comorbidities and COVID-19 deaths.

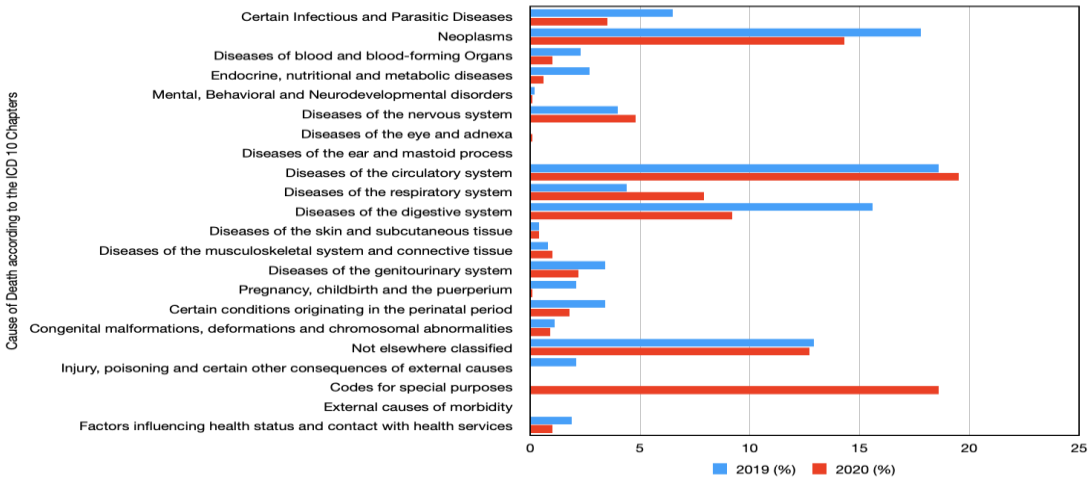

Figure 1: Mortality Pattern according to ICD 10

Table 3: Association of Comorbidities with COVID Patients

Comorbidities	COVID Deaths (n=78) (%)	COVID Survivors whereas, death due to consequences of other causes (n=49) (%)	Total (n=127) (%)
Hypertension	48 (61.5)	4 (8.2	52 (40.9)
Diabetes Mellitus	32 (41)	2 (4.1)	34 (26.8)
Hypothyroidism	2 (2.6)	1 (2)	3 (2.4)
COPD	3 (3.8)	0 (0)	3 (2.4)
Asthma	0 (0)	1 (2)	1 (0.8)
Cardiovascular Disease	10 (12.8)	1 (2)	11 (8.7)
Chronic Liver Disease	3 (3.8)	1 (2)	4 (3.1)
Chronic Kidney Disease	7 (9)	4 (8.2)	11 (8.7)
Tuberculosis	2 (2.6)	0 (0)	2 (1.6)
Cancer (any)	9 (11.5)	2 (4.1)	11 (8.7)
Comorbidity Present	64 (78)	18 (22)	82 (64.6)
No Comorbidity	14 (31.1)	31 (68.9)	45 (35.4)

(odds ratio [OR] = 7.87, 95% confidence interval [CI] = 3.47 – 17.87, chi-square [χ^2]=62.78, P < 0.005)

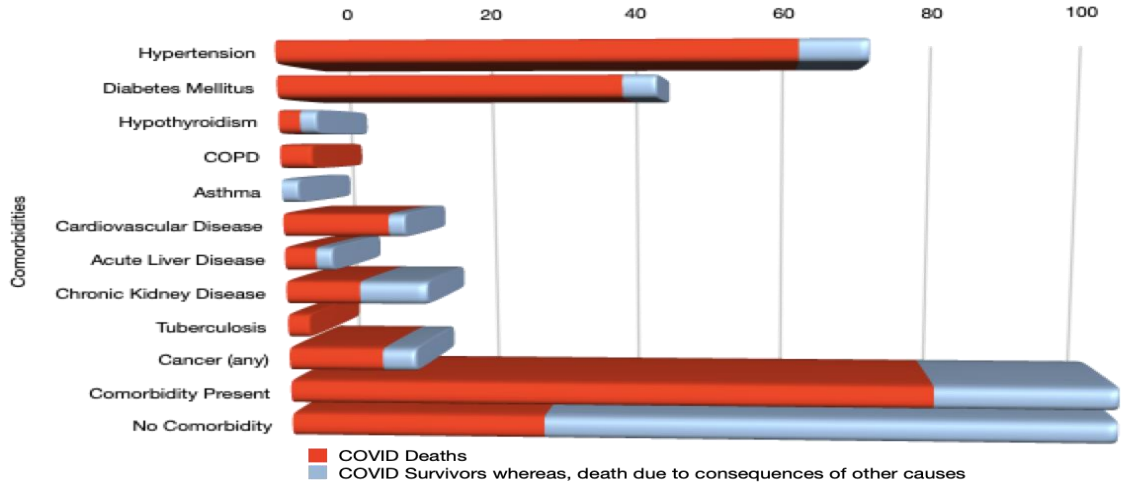

Figure 2: Association of Comorbidity with COVID Patients

DISCUSSION

Although, the hospital data may not constitute national health statistics, they provide valuable indicator of health status in the community. Therefore, the hospital based deaths help to assess burden of diseases, quality of health care and mortality measurement. In the present study the mortality rate per 1000 admission shows increase trend of mortality. Therefore, Joshi et al.[12] their findings of linear trend whereas, Kulkarni et al.[13] their findings of overall decrease trend of mortality. The mortality rate among hospitals may vary because of the degree of variation with severity of illness and quality of care is complex of specific hospital and patient characteristics.[14]

The ratio between total deaths in males (66.1%, n =800) and females (33.9%, n =410) was found to be 1.9:1. A similar finding was observed by other authors too.[15,16] Majority of deaths (42%, n =508) were in the age group between 61-80 years, as also seen in other studies.[17,18] The maximum mortality was among patients admitted in Medicine ICU followed by Surgery ICU and COVID ICU/HDU because the rate of admission is more in these departments. The present study showed that most deaths (59.7%, n=722) occurred within 15 days between 2PM-8PM, findings comparable with other studies.[18,19] There are several factors such as poor health seeking behaviour, out of pocket spending may be associated with maximum death within the two weeks of admission.

The chronic diseases were identified as a leading cause of mortality with cardiovascular conditions predominated by injuries and cancers globally.[3] The present study also revealed that most deaths were caused due to "Diseases of the Circulatory System," accounting for (19.1%, n=231) of the total deaths. Similar findings were seen in studies.[3,17] Joshi et al.[12] also reported a prevalence of diseases of the circulatory system (32%) was the leading cause of death; injury (13%) and infectious and parasitic diseases (12%) were the other major cause of death. Whereas, in our study the "Neoplasms" (15.9%, n=192) was the second largest mortality cause, a similar observation was found in the study done by GBD 2016 cause of death collaborators.[3] In the present study, we found that "COVID-19" (10.5%, n=127) was the third largest mortality cause of death which is maximum in patients with comorbidities (64.6%, n=82), though the conditions like diabetes and hypertension were contributed substantially to the high proportion of mortality and morbidity. Therefore, our study showed (χ^2=62.78, P < 0.005) comorbidities was one of the significant risk factors for the progression of the COVID-19 disease and death. Similar results were seen in the other studies[9–11], where findings suggest that majority of older adults hospitalised with COVID-19 have underlying medical conditions.

CONCLUSION

The study reveals the factors such as male gender, age more than 60 years, duration of hospital stay less than 15 days having Diseases of Circulatory System or, Neoplasms or, COVID-19 with underlying comorbidities was one of the significant risk factors for progression of disease and death. Therefore, by acknowledge the information regarding pattern of mortality, cause of death in a hospital would be helpful for health programmers and managers in planning, also the public health awareness with early detection and prevention of disease with improved health care facilities is the key to reduce mortality.

Limitations: This study took into account only those mortality cases succumbed at our tertiary care centre and may not represent the entire region.

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Conflict of Interest: The authors declare that there is no conflict of interest.

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Ethical Approval: Necessary ethical approval was obtained.

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