



## A STUDY OF COMORBIDITIES AND OUTCOME IN COVID-19 PATIENTS AT A DEDICATED COVID HOSPITAL

<b>Prabhanjan V Kulkarni*</b>	Junior Resident, Department of medicine, Government Medical College and Hospital, Aurangabad, Maharashtra, India. *Corresponding Author
<b>Swapnil R Nirankari</b>	Junior Resident, Department of medicine, Government Medical College and Hospital, Aurangabad, Maharashtra, India.
<b>Bhagyashri B Waghmare</b>	Junior Resident, Department of medicine, Government Medical College and Hospital, Aurangabad, Maharashtra, India.
<b>Sushilkumar P Kamble</b>	Junior Resident, Department of medicine, Government Medical College and Hospital, Aurangabad, Maharashtra, India.
<b>Meenakshi A Bhattacharya</b>	Professor and Head of the Department, Department of medicine, Government Medical College and Hospital, Aurangabad, Maharashtra, India.

### ABSTRACT

**Introduction:** In December 2019, COVID-19 was first identified in Wuhan, China, as a respiratory tract infection causing symptoms, such as fever, chills, dry cough, fatigue, and shortness of breath. The first case in India was reported on 27 January 2020 from Kerala, while the first case in the city where this study was conducted, was reported on 15 March 2020. The study was conducted at a Dedicated COVID Hospital (DCH). We assessed the co-morbidities and other demographic details of COVID positive patients admitted in the first 10 months of the pandemic.

**Methods:** 3187 COVID-19 positive patients admitted in the first wave of COVID-19 from April 2020 to 31 December 2020 were selected, and their demographic details, duration of hospital stay and co-morbidities were studied. Patient details were entered in a spreadsheet and analysis was done using OpenEpi program.

**Results And Discussion:** Of the 3187 patients included in the study, 943 patients died, whereas 2244 patients were discharged from our hospital. Amongst the 943 deaths, 612(65%) were males and 331(35%) were females. The age distribution of the patients who died showed maximum patients in age group of 61-80 years (452 patients, 47.3%). Maximum deaths occurred in September which were 200 (21.20%). When the interval between date of admission and date of death was calculated, it was observed that maximum deaths occurred in the group of 1-5 days (452 deaths, 47.93%). Maximum patients who died had some comorbidity (650, 69%), whereas 293 (31%) patients did not have any comorbidity. Hypertension was the most commonly occurring comorbidity in patients who died, with 108 patients being exclusively hypertensive, and 308 patients having hypertension along with some other comorbidity. Diabetes mellitus (DM) was the second most commonly observed comorbidity in the patients who died, with 86 patients having DM alone, and 245 having DM along with other comorbidities.

Amongst the 2244 patients who were discharged, 1354 (60%) were male and 80 (40%) were female. Maximum patients discharged were from the age group of 41-60 years (918 patients, 40.90%). Maximum discharges were done in September (506, 22.54%). When the interval between date of admission and date of discharge was calculated, it was observed that maximum discharges were in the group of 1-10 days (1173 discharges, 52.27%). Maximum patients who were discharged did not have any comorbidity (1548, 69%), whereas 696 (31%) patients had some comorbidity. Hypertension was the most commonly occurring comorbidity in patients who were discharged, with 175 patients being exclusively hypertensive, and 254 patients having hypertension along with some other comorbidity. DM was the second most commonly observed comorbidity in the patients who were discharged, with 127 patients having DM alone, and 236 having DM along with other comorbidities.

**Conclusion:** Some groups appear to be at higher risk of serious disease progression & increased mortality due to COVID-19. In patients without co-morbidities, 69% recovered whereas 31% died, while in patients with co-morbidities, 69% died whereas 31% recovered. Hypertension was most common co-morbidity observed in dead as well as recovered patients followed by DM. Outcome was poorer in patients with chronic kidney disease, cerebrovascular accidents, ischemic heart disease, and cancer. The ratio of discharges & death in first 10 days of hospital stay was 1.7 & in next 10 days (i.e. day 11-20) was 4.5, i.e. outcome was better in the group of 11-20 days stay in the hospital than first 10 days. Most common age group in patients who died was 61-80 years, while most common age group amongst recovered was 41-60 years.

Multiple strategies can be devised to specifically target these high risk groups to prevent mortality due to COVID-19. Additionally, further studies relating to the pathophysiological processes of COVID-19 especially in high risk groups need to be undertaken which can contribute to development of possible prevention and treatment strategies.

**KEYWORDS :** SARS-CoV-2, COVID-19, Comorbidities, DM, hypertension, outcome, severe

### INTRODUCTION

In December 2019, COVID-19 was first identified in Wuhan, China, as a respiratory tract infection causing symptoms, such as fever, chills, dry cough, fatigue, and shortness of breath. This atypical viral pneumonia has disabled the world, causing catastrophic health and economic losses.<sup>[1]</sup> The first case in India was reported on 27 January 2020 from Kerala, while the first case in the city where this study was conducted was reported on 15 March 2020.

COVID-19 infection is categorized as Asymptomatic, Mild, Moderate and Severe. Asymptomatic illness is one which is incidentally detected with no other signs or symptoms. A patient is said to be having mild illness if he has no shortness of breath, no difficulty in breathing, Respiratory rate < 24/min and SpO<sub>2</sub> ≥ 94% on room air. Moderate illness is one where patient has Shortness of breath, difficulty in breathing, respiratory rate more than 24 but less than 30 per minute, SpO<sub>2</sub>: 90-93% on room air. Severe illness is characterized by

severe shortness of breath, difficulty in breathing, respiratory rate more than 30 per minute, and SpO<sub>2</sub>: less than 90% on room air.<sup>[2]</sup>

Despite the low mortality rate of COVID-19, patients with comorbidities such as hypertension, cardiovascular disease, and diabetes mellitus (DM) seem to be prone to more severe symptoms and to a higher mortality rate than others. Obesity also appears to worsen the prognosis of patients with COVID-19, specifically in younger obese individuals who seem to also be susceptible to a more severe disease. Increasing evidence highlight DM as a distinct comorbidity associated with acute respiratory distress syndrome (ARDS) and increased subsequent mortality.<sup>[3]</sup>

A meta-analysis of 76,993 patients infected with SARS-CoV-2 revealed that hypertension, cardiovascular disease, history of smoking, and DM were the most common underlying diseases with incidences of 16.37%, 12.11%, 7.63%, and 7.87%, respectively.<sup>[4]</sup> From the pooled data of ten available Chinese studies (n = 2209) that have reported the characteristics of comorbidities in patients with COVID-19, hypertension was present in nearly 21%, followed by DM in nearly 11%, and established cardiovascular disease (CVD) in approximately 7% of patients.<sup>[5]</sup>

This study was conducted at a Dedicated COVID Hospital (DCH) in Maharashtra, India. Referred cases from peripheral COVID care centres (CCC) and dedicated COVID health centres (DCHC) were admitted to this DCH. Majority of the admitted cases were having severe COVID illness, or multiple co-morbidities requiring intensive care.

We assessed the co-morbidities and other demographic details of COVID positive patients admitted to the institute in the first 10 months of the pandemic.

**MATERIALS AND METHODS**

3187 COVID positive patients admitted in the first wave of COVID-19, from April 2020 to 31 December 2020, were selected and their demographic details, duration of hospital stay and co-morbidities were studied. Patients admitted under departments of surgery & OBG were excluded from this study. Patients admitted after 31 December 2020 were also excluded from this study. The data was collected in a spreadsheet and the values were analysed using OpenEpi program.

**RESULTS AND DISCUSSION**

Of the 3187 patients included in the study, 943 patients died, whereas 2244 patients were discharged from the hospital.

Amongst the deaths, 612(65%) were males and 331(35%) were females. Amongst the discharges, 1354 (60%) were male and 890 (40%) were female (Table 1).

**Table 1 : Sex Distribution Of Patients**

Sex	Deaths	Discharges	Total
Male	612 (65%)	1354 (60%)	1966 (61.6%)
Female	331 (35%)	890 (40%)	1221 (38.4%)
Grand Total	943	2244	3187

*Chi-square statistic 5.843, df-1, p-value 0.007, the result is significant at p<0.05.*

**Table 2 : Age Distribution Of Patients**

Age (years)	No. of deaths	No. of discharges	Total
<1	1(0.10%)	8 (0.35%)	9(0.28%)
1-20	8(0.84%)	90 (4.01%)	98(3.07%)
21-40	77(8.16%)	669(29.81%)	746(23.4%)
41-60	362(38.38%)	918(40.90%)	1280(40%)
61-80	452(47.3%)	518(23.08%)	970(30.4%)
81-100	43(4.55%)	41 (1.82%)	84(2.6%)

Grand Total	943	2244	3187
-------------	-----	------	------

Maximum patients who died were in age group of 61-80 years (452 patients, 47.3%), followed by 41-60 years (362 patients, 38.38%) and 21-40 years (77 patients, 8.16%) (Table 2). In comparison, maximum patients discharged were from the age group of 41-60 years(918 patients, 40.90%), followed by age group 21-40 years(669 patients, 29.81%) and 61-80 years (518 patients, 23.08%).

*Chi-square statistic 310.6, df-5, p-value <0.0001, the result is significant at p<0.05*

Maximum deaths occurred in September which were 200 (21.20%), followed by august (170 deaths, 18.02%) and july (154 deaths, 16.33%) (Table 3). Maximum discharges were done in September (506, 22.54%) followed by july (397, 17.69%) and August (380, 16.93%).

**Table 3: Month Wise Breakup**

Month	Deaths	Discharges	Total
Apr	7(0.70%)	3(0.13%)	10 (0.31%)
May	55(5.83%)	107(4.76%)	162(5.08%)
Jun	149(15.80%)	206(9.18%)	355(11.1%)
Jul	154(16.33%)	397(17.69%)	551(17.2%)
Aug	170(18.02%)	380(16.93%)	550(17.2%)
Sep	200(21.20%)	506(22.54%)	706(22.1%)
Oct	106(11.24%)	255(11.36%)	361(11.3%)
Nov	55(5.83%)	211(9.40%)	266(8.34%)
Dec	47(4.8%)	179(7.97%)	226(7.09%)
Grand Total	943	2244	3187

*Chi-square statistic 55.69, df-8, p-value <0.0001, the result is significant at p<0.05*

When the interval between date of admission and date of death was calculated, it was observed that maximum deaths occurred in the group of 1-10 days (684 deaths, 72.53%), followed by 11-20 days (203 deaths, 21.52%) and 21-30 days (45 deaths, 4.77%)(Table 4). Maximum discharges were in the group of 1-10 days (1173 discharges, 52.27%), followed by 11-20 days (926 discharges, 41.26%) and 21-30 days (113 discharges, 5.03%).

**Table 4: Interval Between Admission And Death/discharge**

Death interval (days)	Number of deaths	Number of discharges	Total
1-10	684 (72.53%)	1173 (52.27%)	1857 (58.2%)
11-20	203 (21.52%)	926 (42.86%)	1129 (35.4%)
21-30	45 (4.77%)	113 (5.03%)	158 (4.95%)
>30	11 (1.16%)	32 (1.42%)	43 (1.34%)
Grand Total	943	2244	3187

*Chi-square statistic 120.2, df-3, p-value <0.0001, the result is significant at p<0.05*

Maximum patients who died had some comorbidity (650, 69%), whereas 293 (31%) patients did not have any comorbidity. Maximum patients who were discharged did not have any comorbidity (1548, 69%), whereas 696 (31%) patients had some comorbidity. (Table 5)

**Table 5: Comorbidity Distribution**

Comorbidity	Deaths	Discharges	Total
Yes	650	696	1346
No	293	1548	1841
Grand Total	943	2244	3187

*Chi-square statistic 391.2, df-1, p-value <0.001, the result is significant at p<0.05*

Patients with a single comorbidity were counted as 'Exclusively' having that comorbidity, whereas patients having multiple comorbidities were counted under 'with others'

column. For example, a patient having both DM and Hypertension (HTN) was counted under the 'with others' column of both DM and HTN (Table 6). It was observed that hypertension was the most commonly occurring comorbidity in patients who died, with 108 patients being exclusively hypertensive, and 308 patients having hypertension along with some other comorbidity. DM was the second most common, with 86 patients having DM alone, and 245 having DM along with other comorbidities. Other comorbidities observed were ischemic heart disease (IHD), chronic obstructive pulmonary disease (COPD), chronic kidney disease (CKD), old cerebrovascular accidents (CVA), obesity, hypothyroidism and cancer.

**Table 6: Comorbidities Observed In Patients Who Died [n=943]**

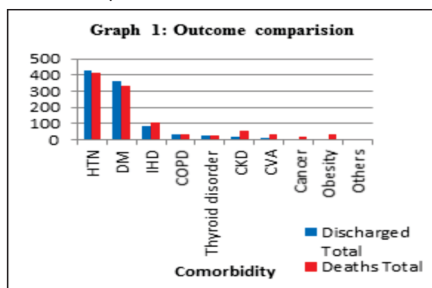
Comorbidity	Exclusive	With others	Total
HTN	108	308	416(44.11%)
DM	86	245	331(35.1%)
IHD	19	91	110(11.66%)
CKD	6	51	57(6.044%)
COPD	12	25	37(3.92%)
CVA	4	30	34(3.60%)
Obesity	8	23	31(3.28%)
Hypothyroid	3	23	26(2.75%)
Cancer	0	18	18(1.90%)

Amongst discharges, it was observed that hypertension was the most commonly occurring comorbidity, with 175 patients being exclusively hypertensive, and 254 patients having hypertension along with some other comorbidity (Table 7). DM was the second most common, with 127 patients having DM alone, and 236 having DM along with other comorbidities. Other comorbidities observed were IHD, COPD, CKD, old CVA, obesity, hypothyroidism and cancer.

**Table 7: Comorbidities In Discharged Patients [n= 2244]**

Comorbidity	Exclusive	With others	Total
HTN	175	254	429(19.11%)
DM	127	236	363(16.17%)
IHD	29	59	88(3.92%)
COPD	14	18	32(1.42%)
Thyroid disorder	10	13	23(1.02%)
CKD	5	11	16(0.71%)
CVA	4	9	13(0.57%)
Cancer	0	8	8(0.35%)
Obesity	1	3	4(0.17%)
Others	65	0	65(2.89%)

A comparative graph of individual comorbidities with outcome (discharges or deaths) is shown in Graph 1. It was observed that hypertension was the most common comorbidity amongst patients who were both discharged or died, followed by DM. 416 (44.11%) of 943 patients who died were hypertensive, whereas 429 (19.11%) of 2244 patients who were discharged had hypertension. 331 (35.1%) of 943 patients who died were having DM, and 363 (16.17%) of the 2244 discharged patients were diabetic. More number of patients having CKD, CVA, IHD or cancer died than were discharged (i.e. outcome was poorer if patients had CKD, CVA, IHD or cancer).



**Table 8: Comorbidities observed in patients\***

Comorbidity	No. of deaths	No. of discharged patients	Chi square value <sup>#</sup>	P value <sup>#</sup>	Risk of death with comorbidity <sup>#</sup>	Risk of death without comorbidity <sup>#</sup>
HTN	108	175	79.27	<0.0000001	38.16%	15.92%
DM	86	127	75.91	<0.0000001	40.38%	15.92%
IHD	19	29	19	0.000006519	39.58%	15.92%
CKD	6	5	12.05	0.0002585	54.55%	15.92%
COPD	12	14	17.15	0.00001725	46.15%	15.92%
CVA	4	4	6.864	0.004398	50%	15.92%
Obesity	8	1	35.01	<0.0000001	88.89%	15.92%
Hypothyroid	3	10	0.4935	0.2412	23.08%	15.92%
Cancer	0	0	-	-	-	15.92%

\*patients having only a single comorbidity considered  
<sup>#</sup> For statistical analysis, the value of deaths and discharges of each comorbidity was compared with total no of deaths without any comorbidity (293) and the number of discharges without any comorbidity (1548)

Results of this study were compared with other studies done during similar time period:

**Table 9: Comparison of results of this study with other studies**

Parameter	This study	Subodh Sharma Paudel <sup>(9)</sup>	Ng WH et al <sup>(10)</sup>	Richarson S et al <sup>(11)</sup>	Hasan Ejaz et al <sup>(12)</sup>
Total patients	3187	1786	-	5700	-
Prevalence of HTN	26.5% (845)	15.8%	21.3%	56.6%	23%
Prevalence of DM	21.7% (694)	9.4%	18.1%	33.8%	58%
Prevalence of malignancy	0.81% (26)	1.5%	-	-	58%
Prevalence of obesity	1.09% (35)	-	18.3%	41.7%	48%
Deaths amongst HTN	13% (416)	-	-	-	6%
Deaths amongst DM	10.3% (331)	-	-	-	8%
Deaths amongst malignancy	0.56% (18)	-	-	-	2%
Deaths amongst obesity	0.97% (31)	-	-	-	68%

**CONCLUSIONS**

1. Out of the total 3187 patients studied, 650 (20.3%) patients who died had some comorbidity, and 696 (21.8%) patients were discharged who had comorbidity. In patients without co-morbidities, 293 (9.19%) patients died whereas 1548 (48.57%) patients were discharged.
2. Hypertension was most common co-morbidity observed in dead as well as recovered patients followed by DM.

Although hypertension and DM were the most commonly observed comorbidities in death, percentage of recovered patients with these comorbidities was more than the percentage of death in patients with those comorbidities.

3. Outcome was poorer in patients with chronic kidney disease, cerebrovascular accidents, ischemic heart disease, and cancer.
4. The ratio of discharges & death in first 10 days of hospital stay was 1.7 & in next 10 days (i.e. day 11-20) was 4.5, i.e. outcome was better in the group of 11-20 days stay in the hospital than first 10 days.
5. Most common age group in patients who died was 61-80 years, while most common age group amongst recovered was 41-60 years.

Some groups appear to be at higher risk of serious disease progression & increased mortality. Strategies can be devised to specifically target these high risk groups to prevent mortality due to COVID-19. These strategies may include increasing awareness about following COVID appropriate behavior by these groups, limiting public contact to avoid exposure to the maximum, and to approach healthcare systems immediately on having even mild symptoms suggestive of COVID-19 infection so that early diagnosis and treatment is possible. Other strategies such as ensuring early and complete vaccination of high risk groups can also be considered. Additionally, further studies relating to the pathophysiological processes of COVID-19 especially in high risk groups need to be undertaken which can contribute to development of possible prevention and treatment strategies.

#### REFERENCES:

1. Wolff D, Nee S, Hickey NS, Marschollek M. Risk factors for COVID-19 severity and fatality: a structured literature review [published online ahead of print, 2020 Aug 28]. *Infection*. 2020;1-14. doi:10.1007/s15010-020-01509-1
2. Directorate General of Health Services, MoHFW, GOI (2021). Comprehensive Guidelines for Management of COVID-19 patients [PDF file]. Retrieved from <https://dghs.gov.in/>
3. Azar WS, Njeim R, Fares AH, Azar NS, Azar ST, El Sayed M, Eid AA. COVID-19 and DM: how one pandemic worsens the other. *Rev Endocr Metab Disord*. 2020 Dec;21(4):451-463. doi: 10.1007/s11154-020-09573-6. PMID: 32743793; PMCID: PMC7395898.
4. Emami A, Javanmardi F, Pirbonyeh N, Akbari A. Prevalence of Underlying Diseases in Hospitalized Patients with COVID-19: a Systematic Review and Meta-Analysis. *Arch Acad Emerg Med*. 2020 Mar 24;8(1):e35. PMID: 32232218; PMCID: PMC7096724.
5. 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 Jul-Aug;14(4):283-287. doi: 10.1016/j.dsx.2020.03.016. Epub 2020 Apr 9. PMID: 32283499; PMCID: PMC7144598.
6. Peely IMD, Azevedo RB, Muxfeldt ES, Botelho BG, Albuquerque GG, Diniz PHP, Silva R, Rodrigues CIS. COVID-19 and chronic kidney disease: a comprehensive review. *J Bras Nefrol*. 2021 Apr 9:S0101-28002021005032301. English, Portuguese. doi: 10.1590/2175-8239-JBN-2020-0203. Epub ahead of print. PMID: 33836039.
7. Siddiqui AF, Wiederkehr M, Rozanova L, Flahault A. Situation of India in the COVID-19 Pandemic: India's Initial Pandemic Experience. *Int J Environ Res Public Health*. 2020;17(23):8994. Published 2020 Dec 2. doi: 10.3390/ijerph17238994
8. Rod JE, Oviedo-Trespalacios O, Cortes-Ramirez J. A brief-review of the risk factors for COVID-19 severity. *Rev Saude Publica*. 2020;54:60. doi: 10.11606/s1518-8787.2020054002481
9. Subodh Sharma Paudel. A meta-analysis of 2019 novel corona virus patient clinical characteristics and comorbidities, 08 April 2020, PREPRINT (Version 1) available at Research Square [<https://doi.org/10.21203/rs.3.rs-21831/v1>]
10. Ng WH, Tipih T, Makoah NA, et al. Comorbidities in SARS-CoV-2 Patients: a Systematic Review and Meta-Analysis. *mBio*. 2021;12(1):e03647-20. Published 2021 Feb 9. doi:10.1128/mBio.03647-20
11. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA*. 2020;323(20):2052-2059. doi: 10.1001/jama.2020.6775
12. Hasan Ejaz, Abdullah Alsrhani, Aizza Zafar, Humera Javed, Kashaf Junaid, Abualgasim E. Abdalla, Khalid O.A. Abosolif, Zeeshan Ahmed, Sonia Younas, COVID-19 and comorbidities: Deleterious impact on infected patients, *Journal of Infection and Public Health*, Volume 13, Issue 12, 2020, Pages 1833-1839, ISSN 1876-0341, <https://doi.org/10.1016/j.jiph.2020.07.014>.