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Original research paper

A STUDY ON CORRELATION BETWEEN MORTALITY AND CO-MORBIDITIES IN PATIENTS WITH COVID 19 INFECTION

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Abstract

Background: Coronavirus disease 2019 (COVID-19) is a new respiratory infection caused by a coronavirus known as SARS coronavirus 2. (SARS- CoV-2). The virus is a member of the coronavirus family, which are zoonotic pathogens that cause and transmit infections between humans and various animals. The World Health Organization (WHO) has designated coronavirus disease 2019 (COVID-19) a pandemic, with 20% of infected individuals requiring hospitalisation and 6% requiring critical care and invasive ventilatory support. Co-morbidities are thought to be a greater risk for reducing the survival probability of SARS-CoV-2 patients. Different types of pre- existing diseases have been identified as co-morbidities in SARS-CoV-2 infection, which increases susceptibility and poses risks of more severe outcomes and deaths in COVID-19 patients.Thisstudy is to identify different co-morbidities of the patients who died due to COVID-19 admitted in GMERS medical college and general hospital in city Gandhinagar in Gujarat state.

Methods: This is a retrospective study of patients admitted to covid hospital, GMERS medical college and hospital, Gandhinagar who had been reported positive either with RT-PCR Test or rapid antigen test and died in hospital during the period of April 2020 to April 2021.

Results: In present study, majority (62.9%) of the study participants were in the age group of 51 to 70 years. The mean age of the study participants was61.91 years.58.4% of the COVID-19 patients were males while 41.6% were females. 93.2% of the COVID-19 patients were having any comorbidity while among 6.8% of the patients were without any comorbidities withhypertension was most common(57.5%) followed by diabetes(53.4%). 44.8% of the

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study patientswere having only single comorbidity while 55.2% were having more than or equals to two comorbidities. The mean interval between hospital admission and death of the patients was 4.5 days.

Conclusion: It has been concluded that old age, male gender has more severe outcome in case of COVID-19. Hypertension and diabetes mellitus were also reported among more than 50% of the patients who died from COVID-19.

Keywords: COVID-19, co morbidities, hypertension, diabetes mellitus

Introduction

Coronavirus disease 2019 (COVID-19) is a new respiratory infection causedby a coronavirus known as SARS coronavirus 2. (SARS-CoV-2). The virus is a member of the coronavirus family, which are zoonotic pathogens that cause and transmit infections between humans and various animals, including cattle, camels, cats and bats. SARS-CoV-2 is a new coronavirus that has never been seen in humans before[1, 2].COVID-19 causes various illnesses, from the common cold to more severe conditions like Middle East respiratory syndrome (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV). It is a highly contagious and pathogenic viral illness that originated in Wuhan, China and has since spread worldwide[3, 4].

The World Health Organization (WHO) has designated coronavirus disease 2019 (COVID-19) a pandemic, with 20% of infected individuals requiring hospitalisation and 6% requiring critical care and invasive ventilatory support. As of 18 May 2022, over 524 million confirmed cases and over 6.2 million deaths have been reported globally. As of 18 May 2022, India reported a total of 43,127,199 confirmed cases and 524,293 deaths[5, 6].

COVID-19 causes diseases such as widespread alveolar epithelium loss,capillary damage/bleeding, hyaline membrane development, alveolar septal fibrous growth, and pulmonary consolidation in the lungs. A cytokine storm causes thrombosis[7].In severe cases of COVID-19, complications such as disseminated intravascular coagulation are common. In the recovered survivors of previous coronavirus pneumonia, persistent impairment of pulmonary function and exercise capacity has been known to last for months or even years[8].Although the source of genesis and transmission to humans is unknown, the quick human-to-human transfer has been generally proven. With a reproduction number (R0) ranging from 2.2-3.5, the illness is highly contagious, which explains its fast spread worldwide[9].COVID-19 has yet to be treated with a clinically licenced antiviral medication or vaccination.However, with clinical recovery, only a few broad-spectrum antiviral medicines have been tested in clinical trials against COVID-19[10].

COVID-19 has a broad clinical spectrum, ranging from mild to moderate cough, headache, rhinorrhea, vomiting and diarrhoea, fever, and shortness of breath to severe pneumonia, acute respiratory distress syndrome, septic shock, and multiple organ failure signs and symptoms[11].Different types of pre- existing diseases have been identified as co-morbidities in SARS-CoV-2 infection, which increases susceptibility and poses risks of more severe outcomes and deaths in COVID-19 patients by modulating virus-host interactions host-immune responses, and also has some age-dependent effects[12, 13].Hypertension, diabetes, heart disease, chronic lung, kidney, and liver diseases, cancers, pro-inflammatory and pro-coagulative states, cerebrovascular diseases, and smoking are just a few examples[14].Identifying numerous risk factors connected to COVID-19 mortality might assist in improving the prevention of COVID-19 deaths.

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During the COVID-19 pandemic, treatment effectiveness and fatality rates were reduced. Medicines to treat heart disease, anti-hypertension medicines to manage hypertension, and glucose-lowering therapies, as well as providing ant-viral treatments, can help COVID-19 patients with co-morbidities minimise their risk of greater severity[15, 16].

Methods

This is a retrospective studyof the patients admitted to covid hospital, GMERSmedical college and hospital, Gandhinagar who had been reported positive either with RT-PCR Test or rapid antigen test and died in hospital during the period of April 2020 to April 2021. 221 cases managed for covid-19 who died in the covid hospitalof GMERS Medical College and Government Hospital Gandhinagar,due Ethical permission was taken andthe case notes of

the pts. were retrieved from the medical record department of the hospital and relevant data extracted and analyzed.

Inclusion criteria

1. All pts. having reported positive either with RT-PCR Test or rapid antigen test and died during admission.

Exclusion criteria

1. Incomplete medical records.

The data obtained were analyzed using SPSS version 21.0 software. Results were expressed in frequencies and percentages

Results

Table 1: Age distribution of study participants (n=221)

Age groups	Number	Percentage
≤40 years	10	4.5
41-50 years	22	10.0
51-60 years	75	33.9
61-70 years	64	29.0
71-80 years	39	17.6
>80 years	11	5.0

As shown in Table 1, majority (33.9%) of the study participants were in the age group of 51 to 60 years. Participants of 61 to 70 years were 29%. Proportion of participants of 71 to 80 years was 17.6%. 5% of the patients were above 80 years while 4.5% were less than 40 years.The mean age of the study participants was 61.97 years with standard deviation of 11.6 years.

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Table 2: Gender distribution of study participants (n=221)

Gender	Number	Percentage
Males	129	58.4
Females	92	41.6

In present study, 58.4% of the COVID-19 patients were males while 41.6% were females. (Table 2)

Table 3: Prevalence of Comorbidities among study participants (n=221)

Comorbidities	Male	Female	Total	Percentage
Present	121 (93.80%)	85 (92.40%)	206	93.2
Absent	8 (6.20%)	7 (7.60%)	15	6.8

As per Table 3, 93.2% of the COVID-19 patients were having any comorbidity while among 6.8% of the patients were without any comorbidities. Prevalence of comorbidities among males and females was 93.8% and 92.4% respectively.

Table 4: Multiple comorbidities (quantitative) among study participants (n=206)

Comorbidities	Male (n=121)	Female (n=92)	Total	Percentage
One	62 (51.24%)	37 (43.53%)	99	44.8
Two	50 (41.32%)	40 (47.06%)	90	40.7
Three	8 (6.61%)	8 (9.41%)	16	7.2
Four	1 (0.830%)	0 (0%)	1	0.5

In present study, 44.8% of the study participants were having only single comorbidity while 55.2% of the COVID-19 patients were having more than or equals to two comorbidities. Among them 7.2% were having 3 comorbidities simultaneously while 0.5% of the patients were having four comorbidities at once. (Table 4)

Table 5: Distribution of comorbidities among study participants (n=206)

Comorbidities	Male(n=121)	Females(n=85)	Total	Percentage
Hypertension	73 (60.33%)	54 (63.52%)	127	57.5
Diabetes Mellitus	66 (54.54%)	52 (61.18%)	118	53.4
Obesity	17 (14.04%)	9 (10.58%)	26	11.8
CAD	11 (9.1%)	8 (9.41%)	19	8.6
Hypothyroidism	7 (5.8%)	8 (9.41%)	15	6.8
Asthma	2 (1.6%)	7 (8.23%)	9	4.1
CVA	6 (4.96%)	1 (1.18%)	7	3.2
COPD	5 (4.13%)	1 (1.18%)	6	2.7
CKD	3 (2.47%)	1 (1.18%)	4	1.8

As per Table 5, the hypertension was prevalent among 57.5% of the COVID-19 patients in our study. Prevalence of diabetes was 53.4% among study participants. Obesity and coronary artery disease was present in 11.8% and 8.6% of the patients with COVID-19. Hypothyroidism and Asthma was seen among 6.8% and 4.1% of study participants. Proportions pf CVA, COPD, CKD were seen among 3.2%, 2.7% and 1.8% respectively

among the patients with COVID-19.

Table 6: Multiple comorbidities among study participants (n=206)

Comorbidities	Frequency	Percentage
HTN, DM	49	22.2
DM	41	18.6
HTN	41	18.6
No	15	6.8
HTN, CAD	7	3.2
Obesity	7	3.2
DM, Obesity	6	2.7
HTN, Asthma	6	2.7
DM, Hyperthyroidism	5	2.3
DM, Obesity, CAD	5	2.3
CAD	4	1.8
HTN, CVA	4	1.8
HTN, DM, Obesity	4	1.8
HTN, Hyperthyroidism	4	1.8
Hyperthyroidism	4	1.8
DM, Asthma	3	1.4
HTN, COPD	3	1.4
CKD	2	0.9
HTN, DM, CAD	2	0.9
DM, CAD	1	0.5
DM, Obesity, Hyperthyroidism	1	0.5
HTN, CKD	1	0.5
HTN, CVA, COPD	1	0.5
HTN, DM, CVA, COPD	1	0.5
HTN, Hyperthyroidism, CVA	1	0.5
HTN, Obesity	1	0.5
HTN, Obesity, CKD	1	0.5
HTN, Obesity, COPD	1	0.5

The most common combination of comorbidities among all participants were hypertension and diabetes (22.2%). Hypertension and diabetes alone were seen among 18.6% each. Other comorbidities like obesity, CAD, CVA, CKD, hypothyroidism was also seen either alone or in combination according to table 6.

Table 7: Symptoms among study participants (n=221)

Symptoms	Number	Percentage
Fever	88	39.8
Cough	95	43
Rhinitis	24	10.9
Sorethroat	38	17.2
Dyspnea	214	96.8
Chestpain	8	3.6

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Diarrhea	8	3.6
Vomiting	6	2.7
Loss of taste	16	7.2
Loss of smell	16	7.2
Body ache	21	9.5
Headache	22	10

As per Table 7, The most common symptom among indoor COVID-19 patients was dyspnea (98%), proportions of cough and fever was 43% and 39.8% respectively. Sore throat, rhinitis, headache and body ache were seen among 17.2%, 10.9%, 10% and 9.5% respectively among study participants.

Table 8: Vitals among study participants

Examination	Mean	SD
Systolic blood pressure (mmHg)	145.9	25.3
Diastolic blood pressure (mmHg)	87.3	10.9
Spo2 on room air (%)	77.25	11.5

The Mean systolic and diastolic blood pressure among study participants were 145.9 mmHg and 87.3 mmHg respectively. The mean oxygen saturation was 77.25% with room air among COVID-19 patients.

Table 9: Investigations among study participants (n=221)

Investigations	Mean	SD
D-dimer (ng/ml)	3243	2841
CRP (mg/L)	184.3	122.9

As shown in Table 9, the mean D-dimer value among COVID-19 patients was 3243 ng/ml with standard deviation of 2841 ng/ml. The mean CRP value was 184.3 mg/L among study participants.

Table 10: Mortality among study participants (n=221)

Mortality	Number	Percentage
Within 24 hours	16	7.2
24-48 hours	62	28.1
48 hours to 1 week	108	48.9
1 week-2 week	31	14.0
More than 2 weeks	4	1.8

According to table 10, 7.2% of the COVID-19 patients had died with in first 24 hours after admission. 28.1% had died within 24 to 48 hours after admission. Majority (48.9%) of the patients died from 48 hours to 1 week after admission. Proportions of mortality among the COVID-19 patients who died from one week to two weeks and more than two weeks were 14% and 1.8% respectively. The mean interval between hospital admission and death of the patients was 4.5 days with standard deviation of 4.2 days.

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Discussion

In the present study, majority (62.9%) of the study participants were in the age group of 51 to 70 years. The mean age of the study participants was 61.97 years with standard deviation of 11.6 years.Sharma A *et al*.[17]had reported mean age of 59.2 years in the patients with COVID-19 which in agreement with the present study. While researches done by Guan WJ *et al*.[18]and Liu B *et al*.[19]had reported lower mean age among the patients of COVID-19. The difference may be due to different study setting and different sample size. In individuals with COVID-19, older age has often been found to be a significant factor related with disease severity or death. The higher prevalence of comorbidities, as well as the elderly's reduced and less responsive innate and adaptive immune systems, are expected to increase the death rate with age.In present study, 58.4% of the COVID-19 patients were males while 41.6% were females. Similar proportions of male and females are reported by Guan WJ *et al*. 18 (57.3% males and 42.7% females). Kansara*et al*. [20]had reported higher proportion of males in his study while Liu B *et al*. [19]had reported higher proportion of females of patients died with COVID-19.Gender is a key, albeit underappreciated, risk factor for COVID-19 and a health determinant. Males have been found to have more severe clinical outcomes and greater death rates in several investigations. According to a meta-analysis, males experience significantly greater negative clinical outcomes, including mortality from COVID-19. The activity of angiotensin-converting enzyme-2 may be triggered by estradiol, according to animal and human research. These findings have a direct bearing on the reported gender differences in COVID-19 results. As a result, early aggressive treatment of males may be necessary. Males with COVID-19 comorbidities and symptoms should be encouraged to seek medical help as soon as possible[21, 22].

In this research, 93.2% of the COVID-19 patients were having any comorbidity while among 6.8% of the patients were without any comorbidities. Koya S *et al*. [23]had reported similar %ages (96%) of the COVID-19 patients were having one or mor comorbidities while lower %ages of comorbidities were reported by Kansara N *et al*.[20]Further lower proportions of 25.1% and 17.1% of the COVID-19 patients with comorbidities were reported by Guan WJ *et al*.[18]and Liu B *et al*.[19]respectively. A systematic literature review and meta-analysis of the prevalence of comorbidities in patients with COVID-19 conducted by Yang *et al*.[24]found that the prevalence of comorbidities was high in patients with hypertension and diabetesand it was suggested that underlying diseases such as hypertension, respiratory disease and cardiovascular disease could be risk factors for severe patient outcomes.

Chronic patients have a weakened immune system as a result of the underlying illness. The fact that patients with chronic diseases have heightened sensitivity to COVID-19 infection puts them at an increased risk for complications such as deterioration of underlying diseases, pneumonia, failure of other organs, sepsis, and other complications; as a result, their chronic diseases may worsen or the patients may die. These findings imply that comorbidities may be associated with a higher risk of mortality in individuals who have been exposed to the COVID-19 virus[25]. The hypertension was prevalent among 57.5% of the COVID-19 patients in our study. Similar proportion of hypertension was noted in Koya S *et al*.[23]Bailly L *et al*.[26]and Sharma A *et al*.[17]had reported 49.6% and 42.61% of hypertension among COVID-19 patients. Lower proportion of hypertension was observed by Guan WJ *et al*.[18](16.9%) and Liu B *et al*. [19](11.1%).

The mechanism of exacerbation associated with underlying conditions remains unclear. The upregulation of the angiotensin converting enzyme-2 (ACE2) receptor is exploited by

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COVID-19 as the route of entry and infection. In the infection, viral envelope proteins bind to and degrade ACE2 receptors, preventing normal ACE2 function, which causes imbalances in ACE2 and induces an inflammatory immune response, known as a cytokine storm, both of which amplify comorbidities within the host. In the mechanism for severe COVID-19 infection, ACE2 is involved in modulating blood pressure and establishing blood pressure homeostasis[27, 28].

In this research, prevalence of diabetes was 53.4% among study participants. Koya S*et al*. [23]had reported higher proportion of diabetes mellitus in the patients with COVID-19. Bailly L *et al*.[26]LiuB *et al*.[19]and Sharma A *et al*.[17]had reported lower%ages of diabetes mellitus among the patients with COVID-19. Elevated glucoselevels in human monocytes directly boost SARS-CoV-2 replication, and glycolysis helps to maintain SARS-CoV-2 replication by producing reactive oxygen species in the mitochondria and activating hypoxia-inducible factor 1-20, both of which promote SARS-CoV-2 replication. It is possible that high blood glucose levels encourage viral growth. It seems that the prevalence of diabetes mellitus, as well as the individual degree of hyperglycemia, are both independently linked with COVID-19 severity and an elevated risk of death. COVID-19 mortality is also increased in the presence of common comorbidities of diabetes mellitus (such as cardiovascular disease, heart failure, and chronic kidney disease)[29, 30].In present research, obesity was seen among 11.8%. Bailly L *et al*.[26]observed higher proportion of obesity (23.9%) is associated with COVID-19 than present study while Liu B *et al*. 19 had reported lower proportion of obesity (7.8%) in his research. Obesity has emerged as one of the most significant risk factors for complications associated with COVID-19. Many countries around the world have reported that BMI ≥ 30 kg/m2 predisposes individuals to severe outcomes in response to SARS-CoV-2 infection. In a study in Italy,31 patients with BMI between 30 and 34.9 kg/m2 were at significantly increased risk of respiratory failure and of admission to ICU whereas risk of death was seen in patients with BMI ≥ 35 kg/m. Obesity with or without T2D has been associated with higher rates of hospitalization and an increased severity of illness.

In present study, 44.8% of the study participants were having only singlecomorbidity while 55.2% of the COVID-19 patients were having more than or equals to two comorbidities. Our study is in agreement with the research done by Koya S *et al*.[23]who reported 56% of the patients were having ≥ 2 comorbidities. Liu B *et al*.[19]and Guan WJ *et al*.[18]had reported lower proportions of the patients with multiple comorbidities as compared to present study.

Dyspnea was the most common presenting complaint in the present study which is consistent with the finding of other studies Badedi M *et al*.[32]and Tendulkar P *et al*.[33]had reported dyspnea among 91% and 73.6% respectively among serious COVID-19 patients.In research conducted by Tendulkar P *et al*. 33 additional symptoms among dead COVID-19 patients besides dyspnea included fever (64.92%) and cough (46.10%). Other less frequent symptoms include sore throat (12.5%), chest discomfort (11.2%), diarrhea (6.3%), headache (2.2%), and loss of taste and smell (1.1%). According to Badedi M *et al*. [32]other clinical symptoms mentioned by hospitalized COVID-19 patients who died included cough (80%), fever (70%), diarrhea (12.8%) and chest discomfort (6%).

In this research, the Mean systolic and diastolic blood pressure among study participants were 145.9 mmHg and 87.3 mmHg respectively. In the study done by Badedi M *et al*. [2] the mean systolic and diastolic blood pressure was 122.9 and 68.2 mmHg respectively among the patients who were died due to COVID-19. High blood pressure is an independent risk factor causing complications in COVID-19 patients.In present study, the mean oxygen saturation

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was 77.25% with room air among COVID-19 patients. Badedi M *et al*.[2]had reported mean SpO2 level of 86.5% among the dead COVID-19 patients.In present study, the mean D-dimer value among COVID-19 patients was 3243 ng/ml with standard deviation of 2841 ng/ml. D-dimer levels were also markedly increased in the COVID-19 patients under investigation, and this finding is in agreement with Badedi M *et al*. [32]. An increase in D-dimer levels is associated with high fibrin degradation products levels and low antithrombin activity, as well as the risk of thrombotic and hemorrhagic complications.The mean CRP value was 184.3 mg/L among study participants in our research. In a study done by Smilowitz NR *et al*.[34]the median CRP value was 108 mg/L A dose response was observed betweenCRP concentration and adverse outcomes.

While the associations between CRP and adverse outcomes were consistent among patients with low and high D-dimer levels, patients with high D-dimer and high CRP have the greatest risk of adverse outcomes. They concluded that systemicinflammation, as measured by CRP, is strongly associatedwith venous thromboembolism, AKI, critical illness, and in-hospital mortality in patientswith COVID-19.

Conclusion

Age has often been identified to be a major factor associated with diseaseseverity or mortality in COVID-19 patients. Also connected with old age are comorbidities, which raise the likelihood of complications and mortality.In present study, 58.4% of COVID-19 patients were men, while 41.6% were women.In this study, 93.2% of COVID-19 patients had at least one comorbid condition. 55.2% had greater than or equal to a single comorbidity, whereas 44.8% had just a single comorbidity.Hypertension, diabetes, and obesity were common in 57.5%, 53.4%, and 11.8% of the COVID-19 patient population, respectively.

The most prevalent presenting complaint (96.8%) in this study was dyspnoea. Also prevalent are fever, cough, sore throat, and chest discomfort. COVID-19patients had a mean oxygen saturation of 77.25% while breathing room air. COVID-19 patients had a mean D-dimer concentration of 3243 ng/ml with a standard deviation of 2841 ng/ml.In the present study. In this study, the average time between hospital admission and death was 4.5 days.

As a consequence of the underlying disease, chronic patients have a weaker immune system. Due to their heightened sensitivity to COVID-19 infection,patients with chronic diseases are at an increased risk for complications such as deterioration of underlying diseases, pneumonia, failure of other organs, sepsis, and other complications; consequently, their chronic diseases may worsen or the patients may die. These data suggest that comorbidities may be related with an increased risk of death in COVID-19-exposed patients.

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Declarations

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