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Association of Comorbidity and Mortality among COVID 19 Patients Admitted in a Tertiary Care Hospital in Tamil Nadu: A Case-Control study.

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ABSTRACT

The aim of the study was to identify the association between comorbidities and mortality among the patients with COVID-19 treated at territory hospitals in Chennai. The research design adopted was a Retrospective Case-Control study. The study population included 165 cases and 173 control patients. Medical records of the COVID-19 patients were utilized to analyze the information. The Odds ratio and the Chi-square tests were employed to ascertain the association between age, morbidity and mortality. The factors of comorbid conditions associated with the death of the patients were diabetes (OR: 3.91; 95%CI: 2.35-6.49), hypertension (OR: 6.02; 95%CI: 4.44-10.54), and hypothyroidism (OR: 20.59; 95%CI: 1.14-369.30). There was an increased odds of death among the COVID-19 patients due to an increase in comorbidities. The study shows that there was an extensive association between age, comorbidities and mortality among patients with COVID-19. COVID mortality is more likely among the elderly with comorbidities.

Key word: COVID 19, comorbidities, Mortality Morbidity, Case-control study.

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INTRODUCTION

The century has come across a pandemic that has been sweeping the globe oblivious and turned 2020 into a nightmare. The severity of acute respiratory syndrome coronavirus 2 (SARS-CoV-2) with rapid transmission has contributed to a global lockdown, including industries, agriculture, education, travel, and technology. The first outbreaks in Wuhan in China, Lombardia in Italy, and New York in the USA have occupied the front lines of the news for a few months. Consequently, COVID-19 has reached every corner of the world, including India. The COVID-19 threat is exacerbated by alarming death rates of 1–5% (10 times those of the flu) and persistent symptoms(*1*).

Considering the fast spreading of COVID-19 and the vertical rise in related morbidity and mortality, the World Health Organization has declared it as a pandemic. Inadequate infrastructure, improper risk assessment with limited clinical parameters, inconsistency in clinical models to predict the outcome of the disease, inadequate documentation, and the initial studies with a description of limited characteristics of illness are core causes that have raised the morbidity and mortality rates (*2*).

A study portrayed that increased age and comorbidities, especially hypertension and diabetes mellitus, were sturdily linked with the severity of COVID-19 and death (*3*). Another study carried out abroad showed that half of the patients admitted to hospital had comorbidities and the prominent comorbidities found were hypertension,

diabetes, and cardio vascular diseases. It also found there was a firm link between age, comorbidities and laboratory abnormalities with the severity of COVID (*4*). Despite the fact that China, the United States and Italy briefly explained a few features of COVID-19, very little is understood about the factors associated with hospital admission, severe disease and death. Some large studies have employed multiple regression to unearth substantial risk factors. Very few studies have been published across the globe to reveal the factors associated with the death of COVID patients (*5*).

The subsistence rate in India differs between states, with Gujarat (6.2%), Madhya Pradesh (4.25), and Maharashtra (3.7%) registering the highest mortality rates(*6*). India continues to encounter a dual burden of infectious and chronic diseases. The Tamil Nadu state has registered 25,79,130 COVID-9 cases with 34, 367 deaths till early August-2021 (*7*). 96% of the cases reported to hospitals requiring hospital admission in late 2020 in Tamil Nadu were above 60 years with comorbidities conditions like diabetes and cardiovascular(*8*) diseases, chronic kidney diseases, hypothyroidism, coronary artery disease and hypertension were more represented in hospital inpatient admission (*9*).

With this backdrop, a retrospective case control study was undertaken in Chennai aiming to identify the association between the comorbidities and mortality among the patients with COVID-19 receiving treatment at territory hospitals in Chennai. This study would pave the way to filling up the gaps in clinical models and strategies for treating COVID-19 patients and optimize clinical management, thereby reducing mortality and morbidity rates among COVID-19 patients.

METHODOLOGY

A retrospective case control study was carried out using the medical records (secondary data) from a tertiary care hospital in Chennai. The cases include the records of all those patients confirmed with RT-PCR for COVID19 admitted to hospital and died of COVID 19 during the first and second wave in 2020 and 2021. The medical records of 200 confirmed COVID19 patients who recovered from COVID19 after admission during the first and second waves were randomly selected without matching for age and sex. Of 200 controls, 173 were included in the analysis after excluding 27 records based on being below the age of 18 and for availability of complete records.

The data pertaining to demographic data, co-morbid conditions, and outcome were obtained from the medical records. All patients with co-morbidity were confirmed cases and on treatment for their co-morbidity even during treatment for COVID 19. The data were collected after obtaining permission from the head of the institution and the institutional ethical committee approval was not obtained as secondary data were used for the study. The association between comorbidity and the outcome was analysed using the Chi-square test, unadjusted odds ratio and 95% confidence interval using standard statistical packages.

RESULTS

Table 1: Demographic profile of the participants

Clinical parameters	Cases no. (%)	Control no. (%)
Age		
18-44yrs	16(13.9)	87(50.3)
45-59yrs	32(27.8)	49(28.3)
60 and above	67(58.3)	37(21.4)
Gender		
Male	85(73.9)	137(82.1)
Female	30(26.1)	36(17.9)
Co- morbidity		
Yes	91(79.1)	76(43.9)
No	24(20.9)	97(56.1)
Symptoms of severe COVID-19 on admission		
Yes	70(60.9)	31(17.9)
No	45(39.1)	142(82.1)
Year of admission in hospital		
2020	47(40.9)	76(43.9)
2021	68(59.1)	97(56.1)

The study population included 165 cases and 173 control patients respectively. The mean ages of the cases and controls were 62± 12.5 and 42.3 ±13.3. The patients over 60 years accounted for 58.3% in cases, while the patients in the age range of 18-44 years constituted 50.3% in controls. Although both case-control groups had male and female representation, the percentage of males in the control group (82.1%) was higher compared to males (73.9%) in the case group (Table 1). Comorbidity was present in 79.1 % of the case group, but not in 56.1 % of the control group. The patients in case (59.1%) control (56.1%) groups reported to hospital seeking admission in 2021 was moderately higher in comparison

Table 2: Association between co-morbidity and outcome of COVID-19

Clinical Parameters		Cases no. (%)	Control no. (%)	OD*	95% CI†	P-Value
Comorbidity	Yes	91(79.1)	76(43.9)	4.839	2.81-8.31	<0.001**
	No	24(20.9)	97(56.1)			
Diabetes	Yes	64(55.7)	42(24.3)	3.914	2.35-6.49	<0.001**
	No	51(44.3)	131(75.7)			
Hypertension	Yes	58(50.4)	25(14.5)	6.023	4.44-10.54	<0.001**
	No	57(49.6)	148(85.5)			
CKD‡	Yes	12(10.4)	13(7.5)	1.433	0.62-3.26	0.39
	No	103(89.6)	160(92.5)			
CVD§	Yes	19(16.5)	7(4.0)	4.693	1.90-11.57	<0.008**
	No	96(83.5)	166(96)			
COPD¶	Yes	10(8.7)	3(1.7)	5.396	1.45-20.06	<0.01*
	No	105(91.3)	170(97.3)			
Obesity	Yes	10(8.7)	1(0.5)	16.38	2.06-129.8	<0.008**
	No	105(91.3)	172(99.5)			
Hypothyroidism	Yes	6(5.2)	1(1.73)	9.468	1.12-79.71	< 0.038*
	No	109(94.8)	172(98.27)			

*OD, Odds ratio; †CI, Confidence interval; ‡CKD, Chronic kidney disease; §CVD, Cardio Vascular Disease; ¶COPD, Chronic obstructive pulmonary disease

Table 3: Association Between Number of Co-Morbidities and Outcome of COVID-19

No. of comorb-idities	Cases	Control	OR†	95% CI‡	P-Value
Nil	29(25.2)	97(56.1)	1		
1	31(27)	44(25.4)	2.356	1.26-4.37	0.007**
2	23(20)	28(16.2)	2.747	1.37 5.47	0.004**
≥3	32(27.8)	4(2.3)	0.0374	0.01-0.11	0.001**

†OR, Odds ratio; ‡CI, Confidence Interval

with the patients in case (40.9%) control (43.9%) did so in 2020.

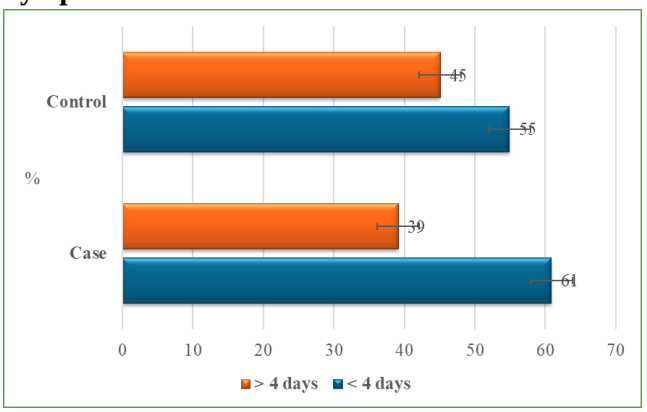
Comorbidity was present in about 79.1% of cases and in 43.9% of controls. The common comorbidity conditions (chronic illnesses) were higher in cases compared to control diabetes (cases 55.7% and control 24.3%), hypertension (cases 50.4% and control 14.5%), chronic kidney disease (cases 10.4% and control 7.5%), cardiovascular disease (cases 16.5% and control 4%), chronic obstructive lung disease (cases 8.7% and control 1.7%), obesity (cases 8.7% and control 0.5%) and hypothyroidism (cases 5.2% and control 1.73%).

Table 4. Association between Severe COVID 19 on admission and mortality

Severe COVID-19	Cases (%)	Control (%)	OR†	95% CI‡	P-Value
Yes	70(66.7)	31(17.9)	7.125	4.153-12.223	0.001**
No	45(33.3)	142(82.1)			

†OR, Odds ratio; ‡CI, Confidence Interval

Figure: Days of Reporting to Hospital from onset of Symptoms



The factors of comorbid conditions strongly associated with the death of the patients were COPD (OR: 1.45; 95%CI: 1.45-20.06), Diabetes (OR:3.91; 95%CI: 2.35-6.49), Hypertension (OR: 6.02; 95%CI: 4.44-10.54), CVD (OR: 4.69; 95% CI: 2.06-129.8), and hypothyroidism (OR: 20.59; 95%CI: 1.14-369.30). It is evident that as the number of comorbidities increased, there was an increased odds of death among the COVID-19 patients. The odds of death were 2.7 times higher in patients with two comorbidities. It is evident to note that there was a statically significant association between comorbidity and mortality about the death of patients due to COVID-19 (P<0.001**) (Table 3). The odds of dying were 7.1 times higher among the case group (66.7%) who had breathlessness of > 30 minutes and oxygen saturation of less than 90 than among the control group (17.9%) who had breathlessness of > 30 minutes and oxygen saturation of less than 90 [OR 7.125, 95%CI, 4.125-12.223] (Table 4).

DISCUSSION

Age, gender and COVID19

The proportion of deaths due to severe COVID-19 in the current study was higher among males (58.3%) and over the age of 60 years than females which differed slightly from another study(10) conducted in Chennai during the same time period, in which the majority of the deceased were also males (71.4%) with a mean age of 62.4 years. A similar observation is (*11–14*) found in few studies that the incidence of mortality owing to severe COVID-19 infection was relatively high among the elderly with comorbidities when compared to other age groups. The bulk of the instances that succumbed to infection with underlying illnesses were individuals over 60 years old, as shown by the studies mentioned. It is critical to concentrate greater attention on older individuals with COVID-19 infection by enhancing health infrastructure and other therapeutic innovations, as well as scaling up prevention strategies to the grass-root level, to minimize mortality rates among them.

Diabetes and COVID19

Over half of the patients (55.7%) with diabetes as a comorbidity succumbed to infection, which was significantly higher than controls in the present study (24.3%). Diabetes patients had a 4 times greater risk of mortality than survivors [OR: 3.914, 95% CI: 2.359-6.492]. According to a study conducted in England, 32.9% of those who died because of COVID-19 also perished with diabetes as a comorbidity. In another study, patients with diabetes had a 3.51 times greater chance of dying during hospitalization (95% CI 316–390)(*15*). Diabetes was found to be 3.9 times greater in patients who died with COVID-19 than in survivors, according to another study. (*16*) COVID-19 individuals had a 3.9-fold greater risk of mortality in another research(*13*). It is evident that diabetes is strappingly linked to an increased risk of mortality in COVID-19 individuals.

Hypertension and COVID19

The percentage of COVID patients with hypertension who died was greater than that of survivors in the current study (50.4% vs 14.5%). The odds of death due to COVID-19 infection were 6 times higher in cases with hypertension compared to controls. Similar studies (*13*,*17*) found the odds of death owing to COVID were 2.21 and 2.37 times higher among patients with hypertension respectively. Similar findings were observed in studies carried out abroad, where the COVID mortality rate was prevalent among patients with hypertension(*18*,*19*). Many studies across the globe articulate hypertension as a comorbidity was one of the causes that claimed many acquitted lives.

Hypothyroidism and COVID-19

Hypothyroidism was found in approximately 5% of the patients in this study, while none of the controls did. The odds of mortality from COVID were 20.5 times higher in hypothyroidism patients than in controls. A similar result was observed in a study(*20*), where patients with thyroid dysfunction had a substantially greater mortality rate (20%) than those who did not (0 percent). Another study, on the other hand, found that the mortality rate among hypothyroidism patients did not vary substantially from that of patients without hypothyroidism(*21*).

CVD and COVID-19

This study showed the proportion of COVID19 patients was 16.5% higher in cases compared to control with 4%. the odds of death were 4.7 times higher in cases with cardiovascular disease compared to controls. Shi S et al(*22*) reported CVD was associated with severity of disease and ICU admission 4.4 times higher covid among patients with CVD as comorbidity.

CKD and COVID-19

In patients with CKD, the odds of mortality due COVID-19 were 1.4 times higher than those in controls, whereas in another study undertaken in Tamil Nadu State(*23*), the

odds of death from COVID were 3 times higher in cases admitted to hospital.

Obesity and COVID-19

In cases, 8.7% of patients were obese, whereas in controls, just 0.5% were obese. In these cases, obese individuals had a 16.3 times greater risk of mortality than the control group. In a comprehensive study, Sameer Mohammad et al(*24*) found that obese patients had a higher risk of severe illness and death from COVID-19 (*25)*. found similar results of obesity as a risk factor for severe COVID-19.

The odds of death rose as the number of co-morbidities increased in the current study. Wei-jie Guan(*26*) published similar findings, stating that having more comorbidities was linked to having severe COVID-19 and having a poor clinical outcome. Multiple comorbidities with COVID-19 substantially raised the chance of mortality, according to Qing-Bin Lu et al(*11*). If there were more than three comorbidities, there was a fourfold odd in mortality. In comparison to COVID-19 patients without comorbidity, the risk of mortality was 18.4 times greater in our research.

CONCLUSION:

Retrospective analysis of the case-control study shows that there was an extensive association between the age and mortality and comorbidities and mortality among the patients with COVID-19. COVID mortality is more likely among the elderly with comorbidities, according to the study. Despite the fact that comorbidities are the primary and underlying causes of mortality in patients, diabetes patients die at a higher rate. The government might optimize its strategies in the public health policies to focus on more chronic and non-communicable diseases that would facilitate it to reduce the mortality rate among COVID and NCD patients. This study would facilitate health care professional to identify patients at risk and provide appropriate and timely treatment. More empirical studies in this area need to be carried out that would discover breakthroughs in treatment of COVID and other chronic diseases.

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