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Retrospective study of Mortality analysis in different Waves during COVID-19 in tertiary care centre of Delhi

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Abstract
COVID 19 is a communicable disease which has spread all over the world due to human-to-human transmission. The initial symptoms are non specific, and it presents with fever and cough, which can then resolve spontaneously or progress to acute respiratory distress syndrome (ARDS), multiple organ failure, and death. This is a retrospective study conducted in a tertiary care center in Delhi to find out association of factors like age, gender and various co morbidities on COVID-19 mortality. Male patients with older age and having co morbidities were found to have higher mortality and results were statistically significant.

Introduction

In 2019, towards the end of year, Pneumonia of unknown origin was identified among people of Wuhan city, Hubei province, China. This pathogenis called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and the disease is called coronavirus disease 2019 (COVID-19). This highly contagion virus belongs to the family of ―Nidovirus which includes ―Roiniviridae, ―Artieviridae and ―Coronaviridae family, which causes respiratory illness in humans. The symptoms vary from very mild to severe and include fever, cough, throat pain, common cold and shortness of breath. Many people are asymptomatic. Symptoms may appear two to fourteen days after getting infected.[1-5]

This disease rapidly spread to other regions around the world, including the Western Pacific, Europe, Eastern Mediterranean, Americas, and Southeast Asia. The World Health Organization declared COVID-19 a pandemic on March 12, 2020.[1,2]

The same day when COVID-19 was declared as a Public Health Emergency of International Concern by WHO, i.e., 30 January 2020, India reported its first COVID-19 case in Kerala. Ministry of Health and Family Welfare, Government of India (GOI) took several preventive measures to curb the spread by implementing social distancing and awareness regarding the novel COVID-19.[6]

As we know India has experienced its three waves of COVID -19 which were very serious and everything had to be under a strict lockdown. In this study,we have analyzed the mortality in each wave and the association with various co-morbidities.

Review of Literature

1. Prabhat Jha, Yashwant Deshmukh , Chinmay Tumbe et al conducted a nationwide study to determine the national covid mortality where they found During the first viral peak, 1.2% of households reported a COVID death (or about 35% of expected all-cause deaths) over 10 days from 24 September to 4 October 2020. There was a second sharp increase in reported COVID deaths from mid-April to the end of June 2021, reaching weekly peaks close to 6% of households. They reported that majority of COVID deaths that India experienced throughout the pandemic occurred from 1 April to 1 July 2021.[7]

2. Krishnan Bhaskaran, et al conducted a study in UK to find out COVID mortality relationship with age and pre existing medical conditions. They found that Older age was more strongly associated with COVID-19 death than non-COVID death (e.g. ORs 40.7 [95% CI 37.7-43.8] and 29.6 [28.9-30.3] respectively for ≥80 vs 50-59 years), as was male sex, deprivation, obesity, and some comorbidities. Smoking, history of cancer and chronic liver disease had stronger associations with non-COVID than COVID-19 death.[8]

3. A study was conducted in Madurai by Ramanan Laxminarayan, where they found that Among RT-PCR-confirmed cases, older age, male sex, and history of cancer, diabetes, other endocrine disorders, hypertension, other chronic circulatory disorders, respiratory disorders, and chronic kidney disease were each associated with elevated risk of mortality.[9]

4. A study conducted in brazil by Tamura, R.E. where they demonstrated that diabetic patients showed worst clinical prognosis as compared to non diabetic population. Also they demonstrated that non metformin group patients had worse prognosis than metformin group.[10]

5. A study conducted to study the impact of diabetes, hypertension, cardiovascular disease and the use of angiotensin converting enzyme inhibitors/angiotensin II receptor blockers (ACEI/ARB) with severity (invasive mechanical ventilation or intensive care unit admission or O2 saturation < 90%) and mortality of COVID-19 cases. The meta analysis showed diabetes mellitus and hypertension were moderately associated respectively with severity and mortality for COVID-19. Cardiovascular disease was strongly associated with both severity and mortality, respectively [OR 4.02 (2.76–5.86) and OR 6.34 (3.71–10.84)].[11]

Method

Aims and Objective

We conducted a retrospective cohort study of all test screenings and cases of COVID-19 in Moolchand Khairatiram Hospital, Lajpat Nagar, Delhi. In our study we analysed the percentage of patients who expired in each wave, and compared the mortality with associated risk factors like age, gender and co morbididties like diabetes, hypertension, cardiovascular diseases, and respiratory diseases.

Study Design

It is a retrospective study. Information was recorded between May 2020 and January 2022 (20 months).

Records were obtained from the medical records department of the hospital.Population data were divided into three waves:

Wave I: May 2020 to February 2021

Wave II: March– June 2021

Wave III: December 2021– January 2022

Statistical analysis

Data of patients were collected and Data were analyzed using Statistical Package for Social Sciences (SPSS) version 21, IBM Inc. A level of $p<0.05$ was considered statistically significant.

Observation and Results

A total of 1750 patients were admitted during the three waves in our hospital. Out of these 236 patients expired. Out of these maximum patients expired in second wave of COVID 19.

Percentage of mortality in each wave is shown in Table 1.

Table 1

Wave	Number of patients admitted	Number of patients died	Mortality %
First	876	59	6.73%
Second	771	162	21.01%
Third	103	15	14.56%
Total	1750	236	13.49%

The patients who expired were sub grouped based on age group i.e less than 50 years, 50-70 years and more than 70 years. Maximum patients who expired were in the age group of more than 70 years and the result was found to be statistically significant. (Table 2)

Table 2

Age group	Number of cases (%)			Total (in age group)
	First Wave (N = 59)	Second Wave (N = 162)	Third Wave (N = 15)	
Less than 50 years	5 (8.5%)	30 (18.5%)	0 (0%)	35 (14.8%)
50 – 70 years	26 (44.1%)	67 (41.4%)	4 (26.7%)	97 (41.1%)
70 years or more	28 (47.4%)	65 (40.1%)	11 (73.3%)	104 (44.1%)
	p-value = 0.043			

In the study, among 236 expired patients, 59.7 % were male and 40.3 % were females. (Table 3)

Table 3

Sex	Number of cases (%)			Total
	First Wave (N = 59)	Second Wave (N = 162)	Third Wave (N = 15)	
Male	38 (64.4%)	94 (58.0%)	9 (60.0%)	141 (59.7%)
Female	21 (35.6%)	68 (42.0%)	6 (40.0%)	95 (40.3%)
	p-value = 0.693			

In the study, patients who expired, co morbidities were present in 70.7% patients whereas absent in 29.3 % patients. The result was found to be statistically significant. ($p < 0.001$) (Table 4)

Table 4

Comorbidity	Number of cases (%)			Total
	First Wave (N = 59)	Second Wave (N = 162)	Third Wave (N = 15)	
Present	55 (93.2%)	97 (59.9%)	15 (100.0%)	167 (70.7%)
Absent	4 (6.8%)	65 (40.1%)	0 (0%)	69 (29.3%)
	p-value = <0.001			

In present study, in patients less than 50 years of age who expired, co morbidities were present in 51.4% patients, whereas in age group between 50-70 years co morbidities were present in 70.1% patients. In patients more than 70 years co morbidities were present in 77.9% patients. (Table 5)

Table 5: Association of age of the patient with comorbidity. (N = 236)

Comorbidity	Number of cases (%)			Total
	Less than 50 years (N = 35)	50 – 70 years (N = 97)	70 years or more (N = 104)	
Present	18 (51.4%)	68 (70.1%)	81 (77.9%)	167 (70.7%)
Absent	17 (48.6%)	29 (29.9%)	23 (22.1%)	69 (29.3%)
	p-value = 0.012			
	Spearman R correlation = -0.178 (p = 0.006)			

In our study, diabetes was present in 62.7 % patients who expired, out of which maximum were in age group of more than 70 years. Also 80% of young patients who expired had diabetes.(Table 6)

Table 6: Association of age of the patient with diabetes mellitus. (N = 236)

Diabetes mellitus	Number of cases (%)			Total
	Less than 50 years (N = 35)	50 – 70 years (N = 97)	70 years or more (N = 104)	
Present	28 (80.0%)	56 (57.7%)	64 (61.4%)	148 (62.7%)
Absent	7 (20.0%)	41 (42.3%)	40 (38.6%)	88 (37.3%)
	p-value = 0.062			
	Spearman R correlation = 0.073 (p = 0.263)			

In our study, hypertension was present in 62.7 % patients who expired, out of which maximum percentage were in young age group (<50 years). (Table 7)

Table 7: Association of age of the patient with hypertension. (N = 236)

Hypertension	Number of cases (%)			Total
	Less than 50 years (N = 35)	50 – 70 years (N = 97)	70 years or more (N = 104)	
Present	28 (80.0%)	59 (60.8%)	53 (51.0%)	140 (59.4%)
Absent	7 (20.0%)	38 (39.2%)	51 (49.0%)	96(40.6%)
	p-value = 0.010			
	Spearman R correlation = 0.187 (p = 0.004)			

In this study, patients who expired 19% people who expired had heart diseases like Coronary artery disease, post PTCA, cardiomyopathies. (Table 8)

Table 8: Association of age of the patient with heart disease. (N = 236)

Heart disease	Number of cases (%)			Total
	Less than 50 years (N = 35)	50 – 70 years (N = 97)	70 years or more (N = 104)	
Present	0 (0%)	18 (18.5%)	27 (25.9%)	45 (19%)
Absent	35 (100.0%)	79 (81.4%)	77 (74.0%)	191(81%)
	p-value = 0.015			
	Spearman R correlation = 0.186 (p = 0.004)			

In our study patients with previously respiratory diseases like asthma, chronic obstructive pulmonary disease, interstitial lung diseases , out of the 236 people 55 (23.3%) patients had these whereas respiratory diseases were absent in 76.6% expired patients. (Table 9)

Table 9: Association of age of the patient with respiratory disease. (N = 236)

Respiratory disease	Number of cases (%)			Total
	Less than 50 years (N = 35)	50 – 70 years (N = 97)	70 years or more (N = 104)	
Present	1 (2.9%)	20 (20.6%)	34 (32.6%)	55(23.3%)
Absent	34 (97.1%)	77 (79.4%)	70 (67.3%)	181(76.7%)
	p-value = 0.757			
	Spearman R correlation = 0.038 (p = 0.564)			

In this study we saw majorly these few comorbidities. In patients who expired in first wave, maximum deaths were seen in patients with diabetes (59.3%) and hypertension (59.3%). In second wave maximum percentage of expired patients had hypertension (74%). In the third wave maximum patients who had expired had previous respiratory diseases. (73%). (Table 10)

Table 10: Distribution of mortality in each wave according to each co-morbidity. (N = 236)

Comorbidity present	Number of cases (%)			p-value
	First Wave (N = 59)	Second Wave (N = 162)	Third Wave (N = 15)	
Heart disease	10 (16.9%)	30 (18.5%)	5 (33.3%)	0.011
Respiratory disease	2 (3.4%)	42 (25.9%%)	11(73%)	0.001
Diabetes mellitus	35 (59.3%)	103 (63.5%)	10 (66.6%)	0.001
Hypertension	35 (59.3%)	120 (74.0%)	7 (46.6%)	0.003
CVA	1 (1.7%)	6 (3.7%)	2 (1.3%)	0.868
Renal disease	8 (13.5%)	28 (17.3%)	4 (26.7%)	0.472

Discussion

This study aimed to find out various reasons which affected mortality in COVID patients. Also, which age group and which gender is the most affected.

In our study a total of 1750 patients were admitted during the three waves in our hospital. Out of these 236 patients expired. Out of these maximum patients expired in second wave of COVID 19. This data was found in accordance with the study conducted by Prabhat Jha[7], where they did a survey of national COVID mortality data and found that there was sharp increase in reported COVID deaths from mid-April to the end of June 2021, reaching weekly peaks close to 6% of householdswhich corresponds to our second wave data. (March 2021- June 2021)

In this study, Maximum patients who expired were in the age group of more than 70 years and the result was found to be statistically significant. (p=0.043). This is similar to a study conducted by Krishnan Bhaskaran[8], et al in UK where they found older age (>80 years) was associated with COVID 19 deaths. In our study maximum patients who expired were male (59.7%) which is similar to study by Krishnan Bhaskaran, et al in UK where they found more mortality in male gender. A study conducted in Madurai by Ramanan Laxminarayan[9], found more mortality in male sex as compared to female gender.

In the patients who expired co morbidities were present in 70.7% patients and maximum patients who expired comorbidities were present older age group (>70 years). Our results were stastistically significant (p- 0.012) and it was in accordance with study by Krishnan Bhaskaran[8] and by Ramanan Laxminarayan[9] where both these studies demonstrated that having comorbidities has a higher risk of mortality.

In our study, diabetes was present in 62.7 % patients who expired, out of which maximum were in age group of more than 70 years. Although it was seen in young mortality 80% patients had diabetes. That is young diabetics were more prone for serious illness in COVID-19. In our study, hypertension was present in 62.7 % patients who expired, out of which maximum percentage were in young age group (<50 years). This was in accordance with a study conducted by de Almeida-Pititto[11] which showed showed diabetes mellitus and hypertension were moderately associated respectively with severity and mortality for COVID-19.

In this study, patients who expired 19% people who expired had heart diseases like Coronary artery disease, Post PTCA or cardiomyopathies. This was in accordance with the study conducted in Madurai by Ramanan Laxminarayan[9] where they found that chronic circulatory problems have increased risk of mortality. Similarly as found in this study, respiratory illnesses were associated with higher mortality. In our study patients with previously respiratory diseases like asthma, chronic obstructive pulmonary disease, interstitial

lung diseases , out of the 236 people 55 (23.3%) patients had these whereas respiratory diseases were absent in 76.6% expired patients.

In this study we saw majorly these few comorbidities. In patients who expired in first wave, maximum deaths were seen in patients with diabetes (59.3%) and hypertension (59.3%). In second wave maximum percentage of expired patients had hypertension (74%). In the third wave maximum patients who had expired had previous respiratory diseases. (73%). It was found in accordance with study conducted by de Almeida-Pititto[11] to study the impact of diabetes, hypertension, cardiovascular disease and the use of angiotensin converting enzyme inhibitors/ angiotensin II receptor blockers (ACEI/ARB) with severity (invasive mechanical ventilation or intensive care unit admission or O2 saturation < 90%) and mortality of COVID-19 cases which showed that diabetes mellitus and hypertension were moderately associated respectively with severity and mortality for COVID-19. Cardiovascular disease was strongly associated with both severity and mortality, respectively.

Conclusion

COVID -19 is itself a disease about which many studies are under process. We still don't know exact mechanisms and causes. But here in our study we could conclude that patients who have co morbidities especially diabetes and hypertension are at higher risk of developing COVID-19.

Male gender and elder age group at higher risk of severe disease and risk factors for mortality.

Limitations

The present study was conducted at a single center with a smaller sample size. Contribution from multi center could have added value to the findings of this study.

There is no conflict of interest.

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