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Impact of Co-Morbidities on Mortality of Patients with Covid-19 Infection

Saima Jatoi[1], Muhammad Adnan Bawany[2], Sunil Dat Maheshwari[3], Muhammad Akbar Memon[4], Zia Masarrat Farooqui[5], Hasham Masood Qureshi[6]

[1]Assistant Professor Pulmonology, Isra University Hospital Hyderabad Pakistan; [2]Muhammad Adnan Bawany, Professor Medicine, Isra University Hospital Hyderabad Pakistan; [3]Assistant Professor Medicine, Isra University Hospital Hyderabad Pakistan; [4]Professor Medicine, Isra University Hospital Hyderabad Pakistan; [5]Specialty Registrar Acute Medicine, Northwick Hospital London; [6]Medical Officer Medicine, Isra University Hospital Hyderabad Pakistan.

ABSTRACT

Introduction: The spread of the corona virus has been so swift and intense that since October of 2020. The first case of this viral infection was reported and diagnosed in December of 2019 and since then this disease has taken no time in turning into a worldwide pandemic.

Aim: To assess the inter-relationship of comorbidities and mortality in patients infected with the coronavirus disease.

Methodology: The method of this study included taking into consideration all individuals infected with the viral disease in the specific time period. This study focuses on achieving results against two outcomes: Mortality as a result of any cause within 30-days after the initial COVID-19 virus detection and severity index data (composite) containing hospitalization and mortality details. The logistic regressions model and Cox proportional hazards regression model were used to adapt the study being conducted to the socio-economic situation. The conclusions drawn from the study were also divided into age groups. A sum total of 200 individuals infected with COVID-19 were taken into consideration for this study. Half of these patients were assessed and were shown to have at least one other disease (comorbidity). These patients were followed up and the median time period for this follow-up assessment was 20 days. Study design: A Cross sectional study. Place and Duration: Isra University Hospital from 1st Feburary 2021 to 31st July 2021.

Results: The results of this study showed that the participants of this study that one or more secondary illnesses (primary illness, in this case, being the coronavirus infection) had a higher chance of death via coronavirus as compared to individuals only infected by the viral infection. The study also brought to attention that as each number of comorbidities grew (for example, if a patient infected with COVID-19 was also assessed positive for hypertension and heart diseases, so did the chance for mortality; 2.14 times per comorbidity.

The adverse impact of one or more comorbidities on people over the age of 50 is much more drastic (higher risk of death) as compared to people under than the said age group.

Conclusion: This study has found that the presence of comorbidities in the considered individuals such as Asthma, chronic obstructive pulmonary disease, chronic kidney disease, chronic liver disease, hypertension, ischemic heart disease, rheumatoid arthritis, diabetes mellitus and HIV were associated with severity in the coronavirus disease as well as a high risk of mortality.

Key Words: Coronavirus, Mortality, Morbidity, Comorbidities, Chronic kidney disease, Chronic liver disease

INTRODUCTION

The first case of this viral infection was reported and diagnosed in December of 2019 and since then this disease has taken no time in turning into a worldwide pandemic, affecting each and every aspect of our lives right before our eyes, in a matter of days. The spread of the corona virus has been so swift and intense that since October of 2020, in the United States of America, this disease has jumped the ladder of the leading causes of mortality and has landed itself the third place, especially for adults of 45 years of age or older.[1] By the first quarter of 2021, over 150 million (accounting for about 2% of the total world population) cases of COVID-19

Corresponding Author:
Sunil Dat Maheshwari, Assistant Professor Medicine, Isra University Hospital Hyderabad Pakistan.
Email: sgmaheshwari86@gmail.com

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were reported, 3 million of which passed away.[2] This sudden increase is only predicted to grow further in the coming years, and also in other countries.[3]

The first case of this virus diagnosed in Pakistan was in the city of Multan on February 26, 2020. As one of the most important cities in Pakistan, Multan reported a large number of affected population as well as a high rate of mortality. Existing research literature on coronavirus disease highlights that the risk factors for acute outcomes of the viral infection mainly include old age. Age is one of the biggest and most prominent risk factors when it comes to predicting mortality or assessing disease for severity in individual cases. Some of the other risk factors, in addition to old age,male gender, hypertension, cardiovascular disease (CVD), diabetes mellitus, cancer, kidney disease and dementia also documented.[4-10]

This research aims to study the direct proportionality of mortality and disease severity of COVID-19 patients with the presence of symptomatic secondary diseases.

METHODOLOGY

In this cross-sectional study, individuals showing a positive nasopharyngeal PCR test result was considered and assessed from1st February 2021 to31st July 2021. Individuals that were not residents of the city under study were excluded from the database. Individuals selected by simple random sampling method. The testing done at all provincial health labs, commercials testing centers as well as all hospital labs using the polymerase chain reaction (PCR) technique. This study has been undertaken keeping in mind ethical sensitivities as its research area envelops a large grouping of the general population. It has made sure to receive, before even taking its preliminary steps, ethical proprietary consent from the Research Ethics Office of university.

The primary outcome was the death rate that should take place within 30 days after the affected has been labeled positive for the presence of coronavirus in the bloodstream. The data including demographic data, comorbidities, COVID-19 PCR and other laboratory results were gathered on a semi structured proforma designed for the study after taking the written informed consent from the patient or the attendant, the data for mortality was received from the attendant on phone call when the patient was not on follow up.

Descriptive analysis was done by calculation of proportions, studying mean values of standard deviation curves (SD) and establishing medians by calculating interquartile value ranges for the variables (IQRs). To compare the datasets of each group, the alive group and the dead group Student-t-test, Chi-Square test, Wilcoxon rank-sum test, Fisher's exact test and Kruskal-Wallis test was done.

The first step of the research procedure was to take into inspection the follow-up period for each infected individual from the time of their positive diagnosis of SARS-COV-2 until the death of or if alive then a period of 30 days is to be considered. As most positive cases were hospitalized even before the diagnosis for COVID-19 was given when the first wave of COVID-19 hit, logistic regression was used as the primary methodology to estimate the impact of the composite severity outcome. While employing the two methodologies, namely the Cox model or the model for logistic regression, there was a need to control various variables such as socio-economic variables, demographic variables, LTC contacts and multiple or singular comorbidities. In order to measure, calculate and analyze values against comorbidities, separate modes of analyses were conducted against three comorbidity-related variants, like the Presence of any comorbidity, number of comorbidities and the types of comorbidity.

This method was used in order to avoid any kind of collinearity in the results. In order to study secondary illness impact on different age strata, two regression models (multivariable Cox model and logistic model) were employed to study the associations between these secondary illnesses and the two outcomes in five age groups. People below the age of 50, People falling within the bracket of 50-59, People falling within the bracket of 60-69, People falling within the bracket of 70-79 and People above the age of 80.

RESULTS

A total of 200 individuals were identified as appropriate for this study group with a positive SARS-COV-2 polymerase chain reaction (PCR) test, out of which 25 were taken out because they were from other cities. In the nutshell, the study was based on a total of 175 (87.5%) individuals as these were in the follow up. The mean age was 42.7±12 with majority of patients were in 60-69 years of age group. 110(62.8%) were males and rest were females. 130 (74.28%) have co morbidities from which a large number have atleast 2 co morbidities.

Unadjusted results of the study held show that other increased the number of comorbidities will have note-worthy associations with individual's deaths. Each individual have multiple co morbidities. The mortality risk is higher in individuals with co morbidities (11.5%) as compared to non comorbid patients (8.8%). **(See Table 1)**

Out of all these diseases, asthma, chronic obstructive pulmonary disease and chronic kidney disease stand at the top of the formation for being the three illnesses causing the highest risk for mortality. **(see Table 2)**

For the purpose of studying the effects of comorbidities on mortality in the context of various divisions of age group, the authors made use of the multivariable Cox hazard regression proportional models. One is compelled to notice that

the number of comorbidities greatly elevate death risks in higher age strata. As age increases, the high-risk influence of the comorbidities increases. If we compare the individuals without comorbidities within the same age stratum, then the ones having five or more than five comorbidities had a death risk multiplied by:395.4 times for people in the age group of 60-79 years, 35.8 times for people falling within the bracket of 50-59 and 12.3 times for people falling less than 50 years. On top of that, individuals more than 50 years of age show an increased mortality risk as well as an increased risk for co-morbidities such as asthma, chronic obstructive pulmonary disease, hypertension, diabetes mellitus, rheumatoid arthritis, Ischemic heart disease, chronic liver disease and chronic kidney disease. The higher number of comorbidities shows a relationshio with higher number of mortality. **(see Table 3)**

Table 1: Specifications of individuals with COVID 19

Characteristics	Individuals Total	Alive	Deceased (within 30 days after contracting COVID)	P-value
Total (percentage)	175	160	19	
Age (mean)	42.7	41.6	82.2	
Age range				0.001
< or = 49	35	34	01	
50-59	30	27	03	
60-69	55	48	07	
70-79	45	41	04	
80+	10	06	04	
Gender				0.015
Male	110	99	11	
Female	65	57	08	
Comorbidities				0.002
No	45	41	04	
Yes	130	115	15	
Comorbidities				
1	35	34	1	
2	40	38	2	
3	30	23	7	
4	15	12	3	
5+	10	4	6	

Table 2: Percentage of mortality in each co morbidities in patients with COVID 19 infection.

Comorbidity	Total Number of patients	Alive	Death
Asthma	20	15 (75%)	5 (25%)
COPD	40	37(92.5%)	3 (7.5%)
HIV	3	2 (66.6%)	1 (33.3%)
Hypertension	80	79 (98.7%)	1 (1.2%)
Diabetes	98	97(99.3%)	1 (1.7%)
Chronic kidney disease	46	43(91.3%)	3 (8.6%)
CVD	29	27 (93.1%)	2 (6.89%)
Rheumatoid arthritis	6	5 (83.3%)	1 (16.6%)
Chronic Liver Disease	13	11(84.6%)	2 (15.3%)

Table 3: Association of comorbidities and age stratum on mortality of COVID 19 patients

Age Stratum	Co-morbidities (Mean Value)	Alive	Death
< or = 49	2	34	01 (2.8%)
50-59	3	27	03 (10%)
60-69	3	48	07 (12.7%)
70-79	4	41	04 (8.8%)
80+	4	06	04 (40%)

DISCUSSION

For the purpose of identifying how much co morbidities adversely impact mortality rate of disease among SARS-COV-2 patients, the authors of this study, initiated such study. Quite a large sum of comorbidities was considered as potential instigators of adverse impact on the coronavirus disease for the sake of this experiment. Out of all the diseases considered, it was found that asthma, COPD, Chronic kidney disease and chronic liver disease were strong predictors of increased mortality risk. It was also found that as the number of secondary illnesses increased in individuals, so did the chances of mortality of COVID-19. Another result post-examination was that as the age increased, this comorbidity and mortality association increased. It was also indicated by the study that if the comorbidity condition was controlled, then age was the strongest factor in influencing risk value for mortality in patients.

The results of this study show HIV to be a non-influencing condition, which is strange and can be because like another study (Harrison's) our study group consisted of a very small percentile of HIV patients (as small as 0.2%).[10] This statement has a high probability of being true because in another study conducted on South Africa, as the number (percent-

age) of HIV patients grew (as high as 20%), the impact of HIV as comorbidity positively influencing mortality also increased.[11]

Another considerable finding of this study work was that in adults older than 50 years of age, the secondary illnesses, did have any considerable effect on the risk of death of the patients.[12] Rather the impact was large and dangerous in individuals older than 50 years instead of those that had not crossed this mid-life line. The conclusive arguments drawn from this study's findings are opposite to those drawn from the research done by Harrison.[13] The authors found that HIV, rheumatoid arthritis, cardiovascular disease and diabetes mellitus posed an elevated risk in individuals below 50 years of age.[14, 15]

The intention behind conducting this study is to bring to light how important it is for vaccination associations to consider not only age but also the number and type of comorbidities that individuals are afflicted by while labeling groups as high-priority groups for swift vaccination (target groups). This is probably the first research conducted to date in the city that is focused on a mortality risk of disease but this study, like all other studies, was carried out with its own set of limitations and had to face many challenges. One of these limitations is that this report only labels comorbidities as factors being only directly relevant to the death risk, not being causal in any way. The establishment of a causal relationship is well beyond the scope of this study.

CONCLUSION

All in all, it can be concluded that diseases such as asthma, chronic obstructive pulmonary disease (COPD), chronic kidney disease, hypertension, diabetes mellitus, cardiovascular disease, HIV chronic liver disease and rheumatoid arthritis are dependable predictors of death risk in COVID-19. It was found and proved by this ongoing argument that the presence of comorbidities in any number, shape or form greatly impacted the risk of mortality in older individuals; older than 50 years of age. Hence, we can state that when the vaccination authorities make their decisions for effective and efficient vaccination protocol they must include 'multiple comorbidities' as an important parenthesis of individuals for priority-based vaccination.

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CONFLICT OF INTEREST

None.

PERMISSION

Permission was taken from the ethical review committee of the institute.

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