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Original Research Article

Co-morbidities: Prevalence and evaluation of risk with COVID-19 (SARS CoV2) infection: A retrospective study

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ABSTRACT

Context: Cases of COVID 19 is a challenge for clinicians to evaluate the effect of SARS CoV2 on patients has preexisting medical illness.
Aim: To assess the potential effect and incidence of COVID 19 with comorbidity.
Settings and Design: 680 COVID-19 positive cases were included. This research was limited to the admitted patients from October 2020 to February 2021. Applicable data were collected from patient's files, reviewed and included based on the applicability to the topic.
Methods and Materials: As of October, 2020, our institute had 954 suspected cases of COVID-19 infection. Out of these 680 patients were positive and rests were negative. We obtained data from the hospital records which provided information regarding the age, gender, chief complaints, co-morbidity and its type, positive /negative status and outcomes (Recovered/death). We divided the patients into three groups; (1) had no co-morbidity; (2) had one co-morbidity (3) had two or more co-morbidity and compared their outcomes (Recovery/Death/admitted). We also compared the outcomes of patients those had more than two co-morbidities.
Statistical analysis: clinical data and co-morbidities were examined with SPSS Statistics, Version 23.
Results: Most patients were male (76.21%) with commonest complain of difficulty in breathing (46.03%). Among total cases, no co-morbidity was noted in 402 (59.11%) patients, one co-morbidity in 205(30.15%) and more than one co-morbidity in 73 (10.74%) patients. Higher death rate was noted in positive patients with two or more co-morbidities (35.62%). Diabetes and hypertension were the common observed illness with higher death rate in COPD and HTN with CAD (75.00%) patients.
Conclusions: Result of this study suggests a strong clinical relationship between COVID-19 and co-morbidities. Patients with pre-existing medical sickness with COVID 19 is a challenge to the physicians as it yielded poorer clinical outcomes. So, the physicians need to be prepared to reorganize their consultative practices during this pandemic period.

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1. Introduction

Native place of SARS CoV2 (severe acute respiratory syndrome coronavirus 2) was Wuhan, China, 2019; now this viral infection is pandemic as announced by WHO, 2020. This has also been proved that clusters of comorbid disease are associated with at greater risk for SARS CoV2 clinical outcomes.[1–4]

The virus enters into the tissue via ACE2 receptors (a carboxyl peptidase enzyme) present in many human cells like lung, heart, liver, kidneys, circulatory and the immune system lead to multi organ dysfunction specially in patients those have co-morbidities; hypertension, diabetes, CAD, CVD, COPD etc as concluded in many literatures. There

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can be many reasons like weak anatomy and muscle atrophy which has bad impact on patho-physiologic functions of infected patients and leads to a poor prognosis.[5–11] The way to developed wide spectrum of illness can be according to the presence of co-morbidity rather than asymptomatic to severe respiratory failure, later was common end outcome of this viral sickness. Task for clinician is very daunting for caring the patients with different medical illness diagnosed with COVID-19 as still no effective vaccine or antiviral medication is available. So, need to take proper history regarding pre-existing illness, identifying associated risk factors and to follow new guidelines for managing these high-risk patients is essential for a better prognosis and to reduce mortality.[9,12–14] We are caring out this literature to know the severity and mortality rate of different or specific medical illness among COVID 19 infected patients.

2. Material and Methods

Observation period of this retrospective study was stared from October 2020 and ended on February 2020, a total of 680 COVID-19 confirmed individuals that diagnosed by RT-PCR on throat and nasal swab samples, were included in our final analysis. The patients were included based on the following criteria: (1) all aged patients (2) confirmed cases of COVID-19; (3) had known clinical conditions, (4) Incidentally diagnosed medical sickness during the treatment for COVID-19, were included. Patients of antenatal care, obesity and had negative reports for COVID 19, were excluded from the study. After agreement on inclusion criteria, all the personal/relevant details about age, gender, prevalence of clinical symptoms, and any type of medical sickness (co-morbidities) were extracted from the medical records or files. All collected data were then reviewed by author's team and further confirmed after taken proper history, physical examination and testing according to medical sickness. Patients were classified into 3 groups based on co-morbidity: (1) those had no comorbidity; (2) had one comorbidity and (3) had two or more comorbidities. We then extracted the data regarding the composite end-points into recovery, death and admitted forms. To assess the role of comorbidities, Group 2 and 3 were further described, takes into account sex (M+F), age, and types of comorbidities, respectively and sorted according to the incidence rate from increasing to decreasing order and compared the composite end-points (recovery/death/admitted). Patients presented with several comorbidities including hypertension, diabetes mellitus, COPD, coronary artery disease, chronic kidney disease, TB, and history of tumors. Age was expressed as mean for statistical purposes and the categorical variables were presented as counts and percentages. All calculations were performed by using the SPSS statistical software, version 23. All statistical analyses were descriptive and no p-values were presented for the statistical comparisons. We performed a research in order to investigate that comorbidities were significantly associated with increased disease severity in SARS-CoV-2-infected patients.

3. Results

During the study period we found 680 reported cases of COVID-19 from 954 suspected cases. Of these 680 cases, mean age was 52.28 yrs and 457 (67.21%) patients were male with M:F ratio of 2.1:1. The most common symptoms were difficulty in breathing (N:313; 46.03%), fever (N:259;38.09%), cough (N:253; 37.21%) and less common was sore throat (N:09; 01.32%). Percentage of asymptomatic cases was 42.21% (N:287) [Table 1].

Table 2 summarizes outcome data. As of February, 2021; During hospitalization 181(26.61%) patients remain admitted, 324 (47.65%) were recovered and 175 (25.74%) patients died. Out of 680 cases, 402 (59.22%) reported cases had no comorbidity, 205 (30.15%) had one comorbidity and 73 (10.74%) had two or more comorbidity with the prevalence of death rate 18.41%, 34.63% and 35.62% respectively. Overall, 175 (25.74%) patients reached to the death points during study period. Recovery rate was higher in no comorbid (59.11%) patients followed one comorbid (30.15%) and more than one comorbid (10.74%) patients. Patients had two or more comorbidity were older (mean age 68.32yrs) versus patients with one comorbidity (42.56yrs).

Table 3 summarizes patients withat least one comorbidity from increasing to decreasing order were: diabetes (N:77; 37.56%), hypertension (N:24; 11.71%), chronic obstructive pulmonary disease (COPD) (N:19; 09.27%), cancer (N:16, 07.80%), chronic kidney disease (CKD) (N:15; 07.31%), coronary artery disease (CAD) (N:14; 06.83%) and Tuberculosis (TB) (N:08; 03.91%). Death rate was higher in COPD (63.16%) followed by TB (50.00%), cancer (43.75%), diabetes (35.06%), CAD (35.72%), hypertension (20.83%) and CKD (13.33%) with highest recovery rate in HTN (62.50%) followed by CKD (60.00%), CAD (57.14%), cancer (56.25%), TB (50.00%), diabetes (48.06%) and COPD (31.58%). In death category mean age was also higher in COPD (62.08%)

We have further identified 73 (10.74%) patients who reported having two or more comorbidities, commonly associated with HTN and diabetes. Prevalence of HTN was higher with DM (N:39; 53.42%) followed by DM,CAD (N:8;10.96%), CKD (N:05; 06.85%), CAD (N:04; 05.48%), COPD (N:03; 04.11%) and cancer (N:02;02.74%). Association of DM and other medical illness was more with CAD (N:06; 08.22%), CKD (N:03; 04.11%) and COPD (N:03; 04.11%). Highest death rate was noted in HTN, CAD (75.00%) followed by HTN,DM,CAD (62.50%), HTN, CAD (50.00%), HTN, cancer (50.00%), HTN,CKD (40.00%), HTN, DM (38.46%) and DM, CKD (33.33%). Mean age of death patients was also higher in HTN, CAD (74.67 yrs). Lowest recovery was noted

in HTN,DM,CAD (25.00%) with highest in DM, COPD (66.67%) [Table 4]. The death rate was documented in 71 (34.63%) patients who had at least one comorbidity as opposed to 30 (41.09%) patients had two or more comorbidities [Tables 3 and 4].

Our analysis revealed that COVID-19 patients who presented with any type of medical illness had an approximately 1-2-fold higher risk of developing severe disease compared to COVID-19 patients with no preexisting chronic conditions. Based on these results, we suggest that COVID-19 patients with a history of medical sickness should be carefully monitored and managed.

4. Discussion

We obtained data regarding demographics including their age and sex distribution. The total number of patients was 680 with 67.21% males and 32.79% females with a male to female ratio of 1.2:1. Mean age was 52.28 yrs. These results were similar to the studies of Paudel, yang el al and many others case series.[1,2,15,16]

Most common symptoms associated with COVID 19 are related to the respiratory system like shortness of breath, difficulty in breathing, chest tightness and others are cough, fever, chills, muscle aches, sore throat, unexplained loss of taste or smell, diarrhoea, and headache.[17] But these symptoms were not detected in all cases of illness that hinders early identification of infected patients. In this study, the most common observed symptoms were difficulty in breathing, fever, cough and sore throat, which were in accordance with the previous literature of Yang et al. Other studies also showed that respiratory insufficiency was a dominating symptom in the majority of cases. Death in these patients could be due to sepsis, bacterial lung infection and diffuse alveolar damage which suggests this virus causes direct lethal lung injury.[16,18–20]

In view of age we observed that patients of two or more comobidity (pre-existing medical condition) were older (mean age 68.32 yrs) than had one or no comorbidity patients (mean age 42.56yrs). Based on previous studies, also suggests that older comorbid patients are the most susceptible to SARS-CoV-2 infection that supported to our data. Present study also represented the analysis of death outcome in a COVID-19 population and suggest that severity of disease was largely dependent on comorbid rather than without comorbid patients and vulnerable to higher risk of mortality rate because of low ability to fight with infection. The listed underlying medical conditions: Diabetes, HTN, CAD, CKD, COPD, and TB were major co-morbidities present in individuals suffering from COVID-19 that leads to increased infection, virulence and fatality. Multiple of published reports showed these medical conditions were the important risk factors on subjects with SARS CoV2 infection. To evaluate these patients appropriate infrastructure like PPE kits and proper transporting system for testing should be available. COVID 19 can transmit to humans via many sources with high mortality rate as SARS-CoV and Middle Eastern respiratory syndrome (MERS)-CoV.[21–27]

Table 2 of my article reflects that Patients with at least one comorbidity, or even more so, were associated with poor clinical outcomes. The two aspects of this outcomes were: virus itself and other was “Cytokine strom”. Medically unfit patients has week immune response and not vulnerable to curb the virus numbers. In “cytokine storm”, immune system starts working hyper-actively and produces inflammatory cascades which cause further damage. Pathogenesis of novel SARS-CoV-2 virus and the original SARS-CoV virus is same as both uses spike protein S to attach the cells via ACE2 protein, and enters the cells following cleavage by TMPRSS2.[28,29] ACE2 receptors are having a major beneficial physiological role in the body like anti-inflammatory and immune system modulation in a favourable way. Mutation or molecular changes in the S protein reduced and increased the binding with human ACE-2. Mutation like the substitution of threonine by serine at position 487, asparagine at position 479, methylation at position 487 and glutamine at position 493 at the receptor binding domain, all these decreased or increased transmissibility of SARS CoV2.[30]

ACE 2 is expressed at high levels on the surfaces of pulmonary epithelial cells, myocardial cells, and arterial smooth muscle cells. This is the reason why there were high risk of mortality in patient having cardiac, pulmonary and arterial disease. ACE2 gene is also located in the X chromosome, a finding show that older men with comorbidities are more likely to have severe COVID-19 infection compared to women.[9,25,31–33]

In our study majority of diseased patients with at least one medical sickness, most common pre-existing health condition were diabetes (37.56%) after that HTN, COPD, CKD, CAD and TB, most frequently affected the endocrine, cardiovascular and respiratory system who lost their lives. Mortality rate was higher in lung disease (COPD; 63.16% and TB; 50.00%) with high mean age that had consistently been reported as risk factors for unfavourable prognosis. After COPD and TB, death was higher in cancer, diabetes, CAD, HTN and CKD. In the systemic review of Morgan et al, 31 out of 33 studies showed diabetes, cardio/cerebrovascular disease, respiratory diseases and hypertension were the four most prevalent and only 10 papers mentioned comorbidity data for their outcomes. In the Study of Wichmann et al common comorbid conditions were Coronary heart disease and chronic obstructive pulmonary disease, the cause of death in these patients were pulmonary thromboembolism that was arise from deep vein thrombosis.[29,34–37]

Other finding of this study was, in patients with more than two comorbidities, HTN with DM (53.42%)

Table 1: Demographics and clinical characteristics of patients

		Number of cases	Percentage (%)
Total cases		954	100
Positive Cases		680	71.28
Negative cases		274	28.72
Details of Positive cases (N-680)			
Age	Mean	52.28yrs	-
Sex	Male	457	67.21
	Female	223	32.79
M:F	Ratio	2.1:1	-
Complaints	Cough	253	37.21
	Fever	259	38.09
	Difficulty in breathing	313	46.03
	Sore throat	09	01.32
	Asymptomatic	287	42.21

Table 2: Distribution of patients according to the presence or number of comorbidity

Category	Total	(%)	Age (Mean)	Recovery	(%)	Death	(%)	Admitted	(%)
No comorbidity	402	59.11	39.20	230	**57.21**	74	18.41	98	24.38
One comorbidity	205	30.15	42.56	102	49.76	71	34.63	32	15.61
More than 2 comorbidity	73	10.74	68.32	28	38.35	30	**35.62**	15	**26.03**
Total	680	100	—-	324	47.65	175	**25.74**	181	26.61

Table 3: Distribution of patients by different comorbidities (At least One comorbidity) and compare of outcomes

Category	No (%)	Recovery			Death			Admitted		
		Age (Mean)	M+F	Total (%)	Age (Mean)	M+F	Total (%)	Age (Mean)	M+F	Total (%)
Diabetes	77 (37.56%)	45.00	21+16	37 (48.06%)	51.33	19+8	27 (35.06%)	53.31	08+5	13 (16.88%)
HTN*	24 (11.71%)	49.67	13+2	15 (62.50%)	48.20	02+3	05 (20.83%)	46.25	02+2	04 (16.67%)
COPD Ď	19 (09.27%)	52.17	04+2	06 (31.58%)	62.08	09+3	12 (63.16%)	48.00	01+0	01 (05.26%)
Cancer	16 (07.80%)	52.17	08+1	09 (56.25%)	62.08	04+3	07 (43.75%)	-	-	-
CKD Ě	15 (07.31%)	41.00	07+2	09 (60.00%)	57.50	02+0	02 (13.33%)	40.75	02+2	04 (26.67%)
CAD §	14 (06.83%)	52.63	08+0	08 (57.14%)	60.02	05+0	05 (35.72%)	70.00	01+0	01 (07.14%)
TB ||	08 (03.91%)	38.75	03+1	04 (50.00%)	53.75	04+0	04 (50.00%)	-	-	-
Rare	32 (15.61%)	40.54	08+6	14 (43.74%)	54.67	07+2	09 (28.13%)	47.11	06+3	09 (28.13%)
Total	205 (100.0%)	-		102 (49.76%)	-		71 (34.63%)			32 (15.61%)

*Hypertension, ĎChronic obstructive pulmonary disease, ĚChronic kidney disease, § Coronary artery disease; ||Tuberculosis

Table 4: Distribution of patients by different comorbidities (two or more comorbidity) and compare of outcomes

Category	No. of cases (%)	Recovery			Death			Admitted		
		Age (Mean	M+F	Total (%)	Age (Mean)	M+F	Total (%)	Age (Mean)	M+F	Total (%)
HTN,DM	39 (53.42%)	54.18	14+3	17 (43.59%)	54.33	13+2	15 (38.46%)	56.43	07+0	07 (17.95%)
HTN,DM,CAD	08 (10.96%)	53.50	01+1	02 (25.00%)	60.00	03+2	05 (62.50%)	59.60	01+0	01 (12.50%)
HTN*, CAD Ď	04 (05.48%)	-	-	-	74.67	03+0	03 (75.00%)	60.00	01+0	01 (25.00%)
HTN,CKD Ě	05 (06.85%)	38.5	01+1	02 (40.00%)	46.0	0+2	02 (40.00%)	38.00	01+0	01 (20.00%)
HTN,COPD §	03 (04.11%)	03	1+0	01 (33.33%)	-	-	-	48.50	0+2	02 (66.67%)
HTN,Cancer	02 (02.74%)	56.00	0+1	01 (50.00%)	61	01+0	01 (50.00%)	-	-	-
DM,CAD	06 (08.22%)	50.00	02+0	02 (33.33%)	59.33	03+0	03 (50.00%)	73.00	01+0	01 (16.67%)
DM,CKD	03 (04.11%)	52.00	01+0	01 (33.33%)	58.00	01+0	01 (33.33%)	70	01+0	01 (33.33%)
DM,COPD	03 (04.11%)	53.50	01+1	02 (66.67%)	-	-	-	48.50	-	01 (33.33%)
Total	73 (100.0%)	-		28 (38.36%)	-		30 (41.09%)	-		15 (20.55%)

*Hypertension, Ď **C**oronary artery disease, ĚChronic kidney disease §Chronic obstructive pulmonary disease.

was the common comorbidity but high mortality was noted in HTN with CAD. In both results HTN was common with poor outcome. These findings were in agreement with many previous articles which imply that hypertension, diabetes mellitus, cerebrovascular disease, chronic obstructive pulmonary disease, and coronary heart disease were common comorbidities and at an increased risk for fatal outcome of COVID-19. Other comorbidities associated with COVID 19, such as carcinoma, chronic kidney disease, chronic liver disease, digestive system disease and nervous system disease had also been reported in many literatures.[6,9,38–43]

As mentioned previously, in the category of patients with one comorbid condition, the rate of mortality was high in lung disease (COPD; 63.16% and TB;50:00%) patients. COPD is a complex disease with abnormalities of the large (central) airways, small (peripheral) bronchioles, poor airflow, destruction of lung parenchyma and irreversible loss of lung function.[44] A recent report said that over one third patients of COVID 19 had respiratory related disease such as COPD. WHO (World Health Organization) also ranked the COPD as the third leading cause of death in COVID 19 patients due to compromised immune response and disease progress to dyspnea, hypoxia, dry cough, excessive fatigue, and sputum production.[45–48] Lue et al 2020, concluded that COVID-19 patients with specific features like COPD, smoking and HTN, rather than cancer-specific features, are the greatest determinants of severity.[49] A large case series from many countries showed that pre-existing COPD worsens the risk of COVID-19 progression and leads to poorer prognostics. In meta analysis of Qianwen et al, 11 articles were included, out of which 1 study reported only on the smoking history, 4 others reported only on the presence of COPD and rest of the studies reported both, the smoking history and the presence of COPD. Death rate was 60% patients with COPD, concluded that presence of COPD was associated nearly fourfold higher risk of developing severe COVID-19 than in patients without COPD. Similar finding was also noted in the studies of Jaber and Zang et al, associated with higher mortality rate of 60%.[50–53] ACE2 may also be raised in COPD patients, noted in many literatures, and promotes the entry of virus; outcome was increased viral load causes extensive lung injury in the form of inflammation, cell death, alveolar damage and edema that impaired the mechanism of gas exchange and resulted in hypoxia.[54–58]

Most frequent CT lung findings including: consolidation, bilateral and peripheral disease, greater total lung involvement, linear opacities, crazy-paving pattern, and the reverse halo sign were noted in many literatures but the hallmarks were bilateral and peripheral ground-glass and consolidative pulmonary opacities.[59] Comment on this point is not possible in the present study due to lack of imaging details of infected patients.

There were many studies conducted regarding COVID 19 and cancer. Few said there was strong relation between cancer and COVID 19, few suggested that cancer did not increase the risk of disease progression and few results were inconsistent.[60–62] In my study, cancer was the third cause of death in COVID 19 patients with mortality rate of 43.75%.

The COVID-19 infection is a double challenge for people with diabetes. In diabetic patients to tackle the

cytokine storms, steroids are given which is an immune suppressor, and cause sugar levels to rise further. But in hypertensive patients, two main reasons of mortality are dysregulation of cytokines due to low immunity which causes systemic inflammatory response syndrome (SIRS) and acute respiratory distress syndrome (ARDS). Second reason is dysregulation of RAAS (rennin aldosterone-angiotensin system) increased the expression of ACE2.[63–65] Hypertension and diabetes patients are treated with angiotensin-converting enzymes (ACE) inhibitors, in these patients, expression of ACE2 is increased. This could facilitate infection with COVID-19 and increase the risk of severe disease and fatality.[66]

The conclusion of our data indicates that when we grouped the population according to the presence of co morbidities and their outcomes; diabetes, HTN and COPD were associated with significant severity and predict the patients to death. Patient with two or more comorbidities are also associated with bad prognosis and had high mortality comparison to patients with one pre-existing medical illness.

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6. Conflicts of Interest

There are no conflicts of interest.

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