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ORIGINAL ARTICLE

Demographic Factors and Co Morbidities Associated with Post Covid-19 Recovery among Admitted Patients in Tertiary Care Hospitals of Khyber Pakhtunkhwa

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ABSTRACT

Objective: To study the relationship of demographic factors and co-morbidities with post-COVID-19 recovery in tertiary care hospitals of Peshawar.

Methodology: This research was conducted in tertiary care hospitals of Khyber Pakhtunkhwa extending over a period of 6 months starting from 1st July 2020 to 31st December 2020. It was an analytical descriptive study (cross-sectional). Patients were selected through a non-probability consecutive sampling technique. Descriptive statistics were performed with SPSS software 22.0 in the form of the mean (sd) and percentages while univariate and multivariate logistic regression scrutiny was performed with STATA version 13.0.

Results: A mean age (48.94±17.57) was observed up to the post-infection recovery or death. The mean age of post-infection recovered patients in the age series of 18-35 years and >55 years was significantly significant (P<0.05) Out of those who recovered, 110 (79.5%) were males and 49(20.5%) were females while those who died of the infection 15(36.6%) were females and 26(83.8%) were males. Univariate analysis showed that age, residence, hypertension, and ischemic heart disease were the covariates significantly associated (p.value <0.05) with post COVID recovery. In multivariate analysis with adjusted OR, "residence" was the only covariate associated with post-infection recovery. Adjusting for the effect of age, gender, hypertension, diabetes, ischemic heart disease, those who were living in urban areas were most likely to recover from COVID-19 infection as compared to the peri-urban residents (OR=0.067, CI: 0.013-0.333). In the full deduced model, adjusting for age, gender, diabetes, hypertension and ischemic heart disease, being an urban resident was 0.08 times more likely to survive or alive after getting COVID-19 infection as compared to dwellers living in city outskirts (OR=0.08, CI: 0.016-0.360).

Conclusion

Patients suffering from chronic hypertension and ischemic heart diseases were the most affected having higher post-infection mortalities compared to diabetic patients while, from a demographic point of view, being a resident of an urban area was a protective factor for post-infection recovery.

Keywords: Demographic factors, co-morbidities, hypertension, ischemic heart disease, diabetes mellitus.

INTRODUCTION

"Initially reported in 1966 by Tyrell and Bynoe who cultured the viruses from patients with ordinary colds, Corona viruses are encapsulated, positive single stranded RNA viruses that can infect humans as well as a variety of other mammals" [1]. "They were named corona viruses (Latin: corona = crown) because of their shape as circular virions with a core-shell and outer projections similar to a solar corona. There are four lineages of corona viruses: alpha, beta, gamma, and delta. Studies have shown that while alpha and beta corona viruses are mostly found in mammals, predominantly bats, gamma and delta viruses are thought to have originated in pigs and birds. SARSCoV2 is a beta corona virus that's part of the B lineage and is closely related to the SARSCoV virus"[2,3]. "At the whole genome level, SARSCoV2 and the bat corona virus are 96 percent identical"[3].

ChanJ and his colleagues described pneumonia as the initial clinical symptom of SARSCoV2 associated disease (COVID19) that permitted case discovery. In addition, recent studies have included gastrointestinal problems and silent infections as well, especially in young children[4]. Up till now, statistics indicate a mean incubation period of 5 days[5]. In 2019, a paper stated that fever, cough, nasal congestion, tiredness, and other upper respiratory tract infection symptoms usually appear after less than a week in symptomatic patients. As revealed on admission by computed tomography, the infection can progress to a severe illness with dyspnea and severe chest symptoms similar to pneumonia in roughly 75% of patients[6]. On clinical examination there was reduced oxygen saturation and radiological investigations showed ground glass abnormalities, patchy consolidation, alveolar exudates, and interlobular involvement. During further lab tests, it was observed that lymphopaena is prevalent, and inflammatory indicators such as C-reactive protein and pro-inflammatory cytokines are elevated. [7].

"The World Health Organization (WHO),in its international situation report, designated the COVID-19 outbreak as the sixth public health emergency of international concern (PHEIC) on January 30, 2020 and on March 11 2020, it was declared as a pandemic"[9]. "Almost 1 436 198 cases of 2019-novel corona virus were reported on April 9, 2020, with 85 522 deaths, a case fatality rate (CFR) of 5.95 percent.COVID-19 poses a very high global danger, according to the WHO. The number of occurrences, fatalities, and affected countries is expected to skyrocket in the next days and weeks."[8]. "The situation in Pakistan is no different and the virus is spreading quickly. On February 26, 2020, the first incidence of COVID-19 was recorded in Karachi, Pakistan, which has a population of 204.65 million people. The virus has spread to many parts of the country and has now become an epidemic. It was recorded on April 10, 2020,that Pakistan had a confirmed count of 4601 COVID-19 cases out of which 727 had recovered and 66 died in just about 45 days."[10].

Despite the fact that this infection is still under research and we are unable to give conclusive evidence based answers, there is a theory that COVID-19 infected patients with co-morbid conditions are at an increased risk of morbity and mortality. Sanyoulo proved in his paper "that the elderly, particularly those in long-term care institutions, and those of any age with major underlying medical

issues are at a higher risk of contracting COVID-19, according to current data and clinical experience"[11]. "A total of 1786 patients were included in one meta-analysis study in Nepal on COVID-19 co morbidities, with 1044 men and 742 women, for a male to female ratio of 1.4:1. The average age of the patients was 41. (interquartile range-0 to 82 years of age). Hypertension (15.8%), cardiovascular and cerebrovascular disorders (11.7%), and diabetes were the most common co morbidities found in these patients (9.4 percent). Superimposed-infection with HIV and hepatitis B (1.5 percent), cancer (1.5 percent), lung illnesses (1.4 percent), kidney disorders (0.8 percent), and immunodeficiencies were the less common co morbidities. (0.01 percentage point)"[12].

Based on this scientific research, it is proposed that epidemiological factors such as age and residence along with co-morbid conditions like diabetes, hypertension, and ischemic heart diseases may contribute a significant role in affecting post-infection recovery and mortality. It is hypothesized in the relatively young study patients without having co morbidities coped better and recovered quicker from covid 19 infections compared to the much older and already diseased population. Hence, the following study was performed to determine the association of demographic factors and co morbidities on the survival (safe discharge) among admitted patients in hospitals of Khyber-Pakhtunkhwa.

METHODOLOGY

This cross-sectional analytical study was conducted in tertiary care and district headquarters hospitals of Khyber Pakhtunkhwa, to measure the relationship of demographic factors and co morbidities on the outcome of SARS-CoV-2 infection. Data were composed from patients' records based on a structured questionnaire after multiple visits. Over three months 200 patients were included using convenient sampling after their informed consent. All patients between the age ranges of 18 to 70 years were considered in the study. The study was accepted by the Institutional Review Ethics Board of Khyber Medical College, Peshawar before the commencement of the study.

Statistical Analysis: Descriptive statistics were performed using SSPSS version 22 and presented in the form of the mean (sd), frequency (percentages). Univariate and multivariate analysis was performed with STATA version 13.0. The binary variable "survived" or "dead" confined to the hospitalization was taken as an independent outcome variable against the covariates age, gender, residence, diabetes, hypertension, and ischemic heart disease. Univariate analysis for unadjusted odds ratio (OR) and its resultant 95 % confidence interval was performed separately for all the covariates. Those variables attaining a p-value less than 0.2 were considered eligible to be included in the full model to have adjusted OR and confidence interval. A P-value less than 0.05 was considered significant. The goodness of fit test was carried out right after multivariate logistic regression analysis to conclude whether the data fits the model or otherwise?

RESULTS

During the three months, a sum of 200 hospitalized patients with a mean age (48.94±17.57) was observed up to the post-infection recovery or death. The mean age of post-infection recovered patients in the age series of 18-35 years and >55 years was significantly different (P<0.05) from those who died of COVID-19.

Out of those who recovered, 110 (79.5%) were males and 49(20.5%) were females. Whereas among those who died of the infection 15(36.6%) were females and 26(83.8%) were males. The distribution of admitted patients concerning the variable "residence" was significantly different (P.vaue <0.05) among recovered and dead patients and the majority of the patients residing in rural and urban areas belonged to the "recovered" category unlike those from peri-urban areas (Table-1).

There was a significant relationship between co-morbid conditions like hypertension (P.value=0.039) and ischemic heart disease (P.value-0.003) with post-COVID-19 mortality (deaths) as compared to diabetic patients who, surprisingly, had better outcomes (P.value=0.184). In terms of demographic factors, there were three age categories, and subjects in the age group of 36-54 had an insignificant association with post-covid-19 survival (P.value-0.920) however, elderly patients above the age of 55 did not have appreciable post-infection recovery and had a higher proportion of mortality (P.value=0.040) (Table-2).

Table 1: Division of the patients according to the outcome and demographic characteristics:

Age group (years)	Recovered (MEAN ±SD)	Died (MEAN ±SD)	P-Value
18-35	28.37+5.685	23.11+4.400	.011
36-55	47.91+5.481	48.11+5.442	.920
> 55	66.02+7.880	70.39+9.129	.040
Gender	Recovered Frequency (%)	Died Frequency (%)	P-Value
Female	49 (30.8)	15(36.6)	
Male	110(69.2)	26(83.8)	0.481
Residence	Recovered Frequency (%)	Died Frequency (%)	P-Value
Peri-urban	3(1.9)	6(2.5)	
Rural	100(62.9)	18(43.9)	
Urban	56(35.2)	17(41.5)	
Total	159	41	0.001

Table 2: Distribution of patients according to outcome and co morbidities

Diseases		Recovered no (%)	Died no (%)	P.value
Diabetic	Yes	45 (28.30)	16 (39.02)	.184
	No	114 (71.70)	25 (60.98)	
Hypertensive	Yes	40 (25.16)	17 (41.46)	.039
	No	119 (74.84)	24 (58.54)	
IHD	Yes	20 (12.58)	13 (31.71)	.003
	No	139(87.42)	28 (68.29)	

Table-3: Univariate analysis of factors related with post COVID recovery.

Covariate	N (%)/Mean	Unadjusted OR	CI for unadjusted OR (95%)	P-value
Age (years)	48.935±17.56712	0.974	0.955-0.994	0.0108
Gender				
Female (Ref)	41(20.05)			
Male	159(79.5)	1.295	0.631 - 2.658	0.4840
Residence				
Rural (Ref)	118(59)			
Urban	73(36.5)	0.593	0.283 - 1.242	0.0033
DK	09(4.5)	0.090	0.021-0 .393	
Hypertension				
No (Ref)	143(71.5)			
Yes	57(28.5)	2.107	1.029 - 4.317	0.0445
Diabetes				
No (Ref)	139 (69.5)			
Yes	61(30.5)	1.621	0.792- 3.318	0.1908
Ischemic Heart Disease				
No (Ref)	167			
Yes	33	3.227	1.439- 7.237	0.0057

Table-4: Multivariate logistic regression

Covariate	N (%)/Mean	adjusted OR	CI for adjusted OR (95%)	P-value
Age (years)	48.935±17.56712	0.993	0.943-1.045	0.8
Gender				
Female (Ref)	41(20.05)			
Male	159(79.5)	0.987	0.439-2.21	0.97
Residence				
Peri-urban (Ref)	09(4.5)			
Rural	118(59)	0.6715	0.300-1.500	0.332
Urban	73(36.5)	0.067	0.013-0.333	0.001
Hypertension				
No (Ref)	143(71.5)			
Yes	57(28.5)	2.0	0.443-9.27	0.149
Diabetes				
No (Ref)	139 (69.5)			
Yes	61(30.5)	0.78	0.292-2.075	0.617
Ischemic Heart Disease				
No (Ref)	167			
Yes	33	2.12	0.808-5.614	0.126

Table-5: Final Adjusted Model

Covariate	N (%)/Mean	adjusted OR	CI for adjusted OR (95%)	P-value
Gender				
Female (Ref)	41(20.05)			
Male	159(79.5)	0.95	0.432-2.095	0.903
Residence				
Peri-urban (Ref)	09(4.5)			
Rural	118(59)	0.682	0.315-1.5	0.333
Urban	73(36.5)	0.077	0.016-0.360	0.001
Hypertension				
No(Ref)	143(71.5)			
Yes	57(28.5)	1.93	0.847-4.404	0.118
Ischemic Heart Disease				
No(Ref)	167			
Yes	33	2.36	0.946-2.37	0.126

Univariate analysis for unadjusted OR with corresponding 95% confidence interval showed that age, residence, hypertension, and ischemic heart disease were the covariates significantly associated (P.value <0.05) with post COVID recovery (Table-3).

Finally, a multivariate regression analysis was performed including gender, being a universal confounder. In multivariate analysis with adjusted OR, "residence" was the only covariate associated with the independent variable. Adjusting for the effect of age, gender, hypertension, diabetes, ischemic heart disease, those who were living in urban areas were most likely to recover from COVID-19 infection as compared to the peri-urban residents (OR=0.067, CI: 0.013-0.333).

In the full deduced model, adjusting for age, gender, diabetes, hypertension and ischemic heart disease, being an urban resident was 0.08 times more likely to survive or alive after getting COVID-19 infection as compared to residents living in city outskirts. (OR=0.08, CI: 0.016-0.360). A goodness of fit test was performed which indicates that the model fits the data (P.value >0.05).

DISCUSSION

The study was performed to investigate the association of demographic and co morbid conditions with the post COVID recovery among admitted patients in tertiary care hospitals of Peshawar Khyber Pakhtunkhwa. "According to one study in China, hypertension (27 percent), diabetes (19 percent), and cardiovascular disease were the most common co morbidities in COVID-19 patients who had acute respiratory distress syndrome (6 percent)"[14] Interestingly, adjusting for age, gender, and co morbid conditions like diabetes, hypertension, and ischemic heart disease, being an urban resident was found a protective factor for post COVID recovery as compared to those who reside in peri-urban areas. Unexpectedly, diabetes was not a significant risk factor for COVID-related mortality in our study sample.

"An additional longitudinal study in Wuhan(China) involving 7300 patients, subjects with T2D showed significantly higher mortality (almost three times higher) from COVID-19 than non-diabetes in 168 fatal pneumonia cases caused by COVID-19 ."[13]. "Furthermore, individuals with diabetes have a 14.2 percent higher probability of ICU admission in COVID-19 than those without the disease."[14]. Surprisingly, the diabetic patients in our study appeared to have relatively better post-covid-19 outcomes as already mentioned in the results section. One possible explanation might be the timely intervention in terms of glycaemic control during hospitalization.

"Clinical trials in Italy observed that hypertension was present in roughly 75% of individuals who died in Italy as a result of the pandemic. There is growing evidence that people with hypertension are more susceptible to COVID-19 than people who are healthy. To prove this "a structured study based meta-analysis on the relationship between hypertension and COVID-19 found that individuals with hypertension have a nearly 2.5-fold increased risk of severe forms of COVID-19 (Odd Ratio, OR 2.49)"[13].The data from our study shows approximately similar statistics: out of 200 patients 57 patients(mean=28.5) had a systolic blood pressure raised than 160 mm hg and 17 patients died after prolonged ICU care (odds ratio OR=2.107).Some research centres have ruled out hypertension as an independent risk factor for COVID-19 morbidity [15]. "There is currently only minimal clinical evidence that antihypertensive therapies can affect COVID-19 prognosis. Despite the absence of evidence, the European Society of Cardiology (ESC) Council on Hypertension recommends that physicians and patients continue to take their standard antihypertensive medications."[16].

For the cardiovascular system, "a survey of approximately 44,000 COVID-19 patients with cardiovascular disorders found a five-fold increase in mortality compared to previously healthy individuals (10.5 percent and 2.3 percent, respectively)."[13]. " Some reports from Europe suggest that SARS-CoV-2 and MERS-CoV have similar pathogenicity, and the myocardial damage caused by infection with these viruses undoubtedly increases the difficulty and complexity of patient treatment" [17,18]. In our setup, we were able to perform regular ECGs for COVID-19 patients and patients with a known history of cardiac diseases had an echocardiogram done as well. Based on these investigations, it was observed that cardiovascular diseases are major risk factors for COVID-19 affected patients: our figures showed 33 patients suffering from ischemic heart disease, and the unadjusted OR for this condition was 3.227. Owing to the previous research work already done on the novel corona virus which states that it causes a hypercoagulable state through certain mechanisms, we may conclude that to be the explanation why patients with hypertension and heart diseases like myocardial infarction, coronary artery disease, or cardiomyopathies didn't respond positively after they were infected with COVID-19. "COVID-19's elevated risk in pre-existing CVD patients could be attributed to ACE-2 receptors. The presence of these receptors on cardiac muscle cells suggests that the cardiovascular system may be involved in SARS-CoV-2 infection"[21].

The study results cannot be generalized on account of the small sample size of tertiary care hospitals considering only two aspects of the disease: co-morbid conditions and demographic factors.

Unfortunately, there are limited stats on demographic factors. One Newspaper reported that "in low- and middle-income nations, a higher proportion of COVID-19 deaths occur at younger ages than in high-income countries. According to statistics from 26 countries, adults aged 70 and up account for 37 percent of COVID-19-related deaths in low income states, compared to 87 percent in high income states" [19]. For gender, "the general consensus is that, while the number of male cases is similar to the number of female cases, males have around twice the chance of dying from COVID-19, leading to a variety of ideas ranging from lifestyles to genetic variations."[20]. The statistical analysis from our study depicts a strong association between urban dwellers and better outcomes in terms of post-infection recovery and hospital discharge as compared to rural and peri-urban dwellers. However, the study of gender-wise distribution analysis did not show any correlation as shown by the P-value of 0.481. In addition to this, our sample data was divided into three age groups and as already predicted in the null hypothesis, the elderly population did not cope well with covid-19 and their post-infection outcomes were relatively unsatisfactory compared to the younger population.

Recommendations: Further large-scale studies are required to compare patient's recovery rates among urban and rural populations. Based on the findings of this study decentralization of resources in terms of clinical care and expertise at the district level in rural areas along with strengthening the primary health care (PHC) are recommended. Irrespective of our study results strengthening family medicine at the PHC level with a proper referral mechanism will reduce the burden on the tertiary care hospitals. This may help in coping well with pandemics and other non-communicable diseases.

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