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Association of HRCT severity score, pre-existing comorbidities, and ABO blood group with treatment outcomes of COVID-19 patients admitted in a hospital of Western Nepal

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ABSTRACT

Background: Although many studies have reported the association of different factors with the severity of coronavirus disease (COVID) patients, no concrete scientific conclusions have been reported till date. **Aim and Objective:** This study aimed to conduct a prospective analysis on different factors associated with the severity and outcome of the COVID-19 patients. **Materials and Methods:** The study was conducted in a 100-bedded hospital of West Nepal for 3 months, with the total number of hospitalized patients 78. Demographic data, pre-existing comorbidities, ABO blood group, high-resolution computed tomography (CT) severity score, and outcomes of the respondents were recorded and analyzed statistically using Chi-square, binomial regression test, and significance level was considered $P<0.05$ at 95% confidence intervals. **Results**: Although the improvement rate was higher among males (84.0%) than females (75.0%), no significant association was observed between sex of the patient and treatment outcomes. Similarly, no significant association was observed in between age and ABO blood grouping of patients and treatment outcome. Furthermore, the chance of improvement is about 6 times higher (OR-6.214, 95% CI: 1.452–26.599; $P=0.014$) among patients with single comorbidity compared with patients with two or more comorbidities. Moreover, the chance of improvement is 8 times higher (OR-8, 95% CI: 2.034–31.461; $P=0.001$) in patients with CT severity score 1–15 compared with patients with CT severity score 16–25. **Conclusion:** CT severity score and pre-existing comorbid conditions play an important role among the different associated factors with the severity and treatment outcomes of COVID-19 patients.

Key words: ABO blood group; Coronavirus disease 2019; High-resolution computed tomography; Pre-existing comorbidities; Severity score; West Nepal

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INTRODUCTION

Initially, coronavirus (RNA virus) was named 2019-nCOV, now known as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Later, the World Health Organization (WHO) named this pandemic as coronavirus disease 2019 (COVID-19).[1] Four types of coronavirus have been found as (I) α-coronavirus, (II) β-coronavirus, (III) δ-coronavirus, and (IV) γ-coronavirus and found that alpha and beta variants are responsible for human coronaviruses.[2] This virus was first identified in a seafood market in Wuhan City, Hubei Province in China, at the end of 2019.[3]

The incubation period is supposed to be 2 weeks after the exposure to the COVID-19 virus, and the median incubation period with symptomatic presentation appears around 5 days post-exposure.[1] The virus could remain contagious in the aerosols for up to 3 h and remain viable

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on hard surfaces such as plastic and stainless steel for about 72 h.[4] Although there are no specific clinical features that can yet reliably distinguish COVID-19 from other viral respiratory infections, some common symptoms are fever, cough, dyspnea, headache, sore throat rhinorrhea,[5] varying number of white blood cells, the appearance of decreased number of lymphocytes, and leukocytes, an increased number of serum procalcitonin levels appear.[6] Three main strategies are done for the diagnosis of COVID-19 such as (a) detection of the virus using reverse transcriptase polymerase chain reaction (RT-PCR), (b) detection of antibodies (immunoglobulin [Ig]M/IgG) to the virus using enzyme-linked immunosorbent assay, and (c) imaging modalities like computed tomography (CT) scan to identify the extent of lung involvement. Among the different clinical specimens, bronchoalveolar lavage (93%) has the highest positivity rate for SARS-CoV-2 followed by sputum (72%) and nasal swabs (63%).[1]

Though virus was initially identified in China, 2019, the virus then rapidly spread to other countries as Germany, Iran, France, Thiland, Japan, South Korea, Vietnam, Canada, The United States, Nepal, India and other so many countries. Hence, World Health Organization has announced coronavirus disease 2019 (COVID-19) as a pandemic in March 2020.[7] Nepal is among one of the nine countries that reported just five cases of COVID-19 as of March 28, 2020.[8] However, Nepal has detected more than 200 cases per day consecutively since June 1, 2020. Finally, a countrywide lockdown came into effect in Nepal on March 24. As Nepal has a fragile health-care system and lacks the necessary infrastructure to cope with an increasing number of infections, it needs to focus on strengthening the health-care system country wise to control the present and future epidemics and should encourage people to maintain social distance.[9]

Many previous studies suggest the different responsible factors for the severity and outcome of COVID-19 patients, which include age, sex, comorbidities, CT severity score, and blood group.[10] Age and sex are some of the most important factors associated with the increase in mortality of COVID patients,[11] pre-existing comorbidities such as hypertension, diabetes, cardiovascular diseases, kidney disease, pneumonia, and asthma raise the probability of hospitalization and death of COVID-19 patients.[12] Furthermore, CT severity scores reflect the association of higher rates of death in COVID-19 patients.[13] Some previous studies have also reported that blood group ABO is associated with the severity and outcome of COVID-19 patients.[14-21] Despite having different theories and suggestions on COVID-19, no scientific conclusion has arrived in date as well as to control and prevent current pandemic, it is necessary to identify the risk factors for COVID-19 infection, this study aimed to conduct a prospective analysis on different factors associated with severity and outcome of the COVID-19 patients, analyzing their demographic characteristics, ABO blood types, CT severity score, and observed overall COVID-19-associated treatment outcomes.

Aims and objectives

This study aimed to conduct a prospective analysis on different factors associated with the severity and outcome of the COVID-19 patients.

MATERIALS AND METHODS

Study population

This study was conducted from August 10, 2020 to October 10, 2020 in a 100-bedded Hospital of West Nepal where COVID dedicated wards were in operation at the peak time of COVID 1st wave in Nepal. The diagnosis of COVID-19 was confirmed by a positive real-time RT-PCR test of SARS-CoV-2 on nasal and pharyngeal swab specimens from patients.[22] The study was conducted after taking consent from the patient's relatives. Only the patients admitted in the COVID ward with confirmed RT-PCR were included in the study.

Ethics approval and consent to participate

Institutional Review Committee, Fishtail Hospital and Research Center, Pvt. Ltd., Pokhara, Nepal, with reference no. 077/078/247 approved the study. For the data collection, patient's consent was taken with patient's visitors.

Data collection

The demographic data of the respondents were taken as gender and age. Age was categorized into three classes as age group from 19 to 39, 40 to 59, and 60 or above. Different pre-existing comorbid conditions such as hypertension, diabetics, kidney disease, cardiovascular disease, pneumonia, and asthma were recorded. Comorbidities conditions are categorized into three classes according to the presence of no pre-existing comorbidities, patients suffering from at least one comorbidity condition, and patients suffering from at least two or more comorbidities, respectively, as no comorbidities, at least one comorbidities, and two or more comorbidities.[23]

The blood group of individual respondent was confirmed as Rh +ve or Rh -ve and then the distribution of blood types among a sample of confirmed COVID-19 individuals.[24] The high-resolution CT severity score of COVID-19 patient was measured by radiologist using CT machine Somatom Spirit manufactured by Siemens in Germany Syngo. Moreover, obtained data were classified

into two groups, that is, CT severity score 1–15 categorizes COVID patients having mild to moderate, and CT severity score 16–25 categorizes COVID patients having severe symptoms. Furthermore, the outcome of treatment was recorded as improved and not improved. Improved refers to the patient who has been discharged and the patients who want to get discharged on their own. In addition, not improved refers to the patient who is fatal and is referred to higher centers for further advanced treatment.[25]

Statistical analysis

All statistical analyses were performed using Statistical Package for the Social Sciences statistical software (version 20.0, IBM). Descriptive statistics were reported as percentages and frequencies. In addition to finding out the association between dependent and independent variables, Chi-square and binomial regression tests were applied. Statistical values were considered significant at $P<0.05$ at 95% confidence intervals.

RESULTS

Sociodemographic characteristics of respondants

The total number of respondents for this study was 78. Out of 78, around 36% were female and 64% were male. Most of the respondents were age group above 60 (53.8%) and least was at the age group of 19–39 (20.5%), as shown in Table 1.

Different factors associated with COVID-19 patients

Blood group, pre-existing comorbidities, and CT severity score are major factors that are directly or indirectly responsible for the severity of COVID-19 conditions. We have studied the categorization of ABO blood group, comorbidities as no comorbidities, single, and two or more comorbidities, and CT severity score and discharge outcome, as shown in Table 2. Among the studied ABO (Rh +ve) group, it was found that a higher proportion of respondents have blood group A, that is, 41% and the least proportion was blood group AB (Rh +ve) which is 9% of the total population. Respondents with single comorbidities were found in higher proportion, that is, 41% than no comorbidities (29.5%) and two or more comorbidities, that is, 29.5%. CT severity score was studied in two categories, that is, from 1 to 15 (57.7%) and 16 to 25 (42%). It was found that a higher proportion of respondents was improved in symptoms and discharged from the hospital (80.8%).

Table 1: Frequency of sociodemographic characteristics of respondents (n=78)

Variables	Frequency (n)	Percentage
Sex		
Female	28	35.9
Male	50	64.1
Age		
19–39	16	20.5
40–59	20	25.6
60 or above	42	53.8

Association of factor with treatment (outcome) in COVID-19 patients

Although the improvement rate was higher among males (84.0%) than females (75.0%), no significant association was observed between the sex of the patient and treatment outcome. Similarly, the chance of improvement is about 6 times higher (OR-6.214, 95% CI: 1.452–26.599; P=0.014) among patients with single comorbidity compared with patients with two or more comorbidities. However, no significant association was observed between patients with two comorbidities and patients with no comorbidities. Moreover, the chance of improvement is 8 times higher (OR-8, 95% CI: 2.034–31.461; P=0.001) in patient with a CT severity score of 1–15 compared with patient with a CT severity score of 16–25, which is shown in Table 3.

DISCUSSION

COVID-19 is highly contagious that the WHO has declared it as a global pandemic. Although China, Europe, America, and India are highly affected, most of the countries in the world are affected in different ways somehow. At present, COVID-19 also has spread all over Nepal, with a rapid increase in the number of new cases and deaths, which is alarming in a low-income country with an inadequate health-care system like Nepal.[26] This study was to know about the many factors responsible for the severity of COVID-19. We studied the effect of blood group, pre-existing comorbidities, CT score, age, sex on severity, and improvement of COVID-19 patients.

Table 2: Association of different factors with COVID-19

Variables	Frequency (n)	Percentage
Blood group (Rh+ve)		
A	32	41.0
B	25	32.1
AB	7	9.0
O	14	17.9
Comorbidities categories		
No comorbidities	23	29.5
Single comorbidity	32	41.0
Two or more comorbidities	23	29.5
CT severity score		
1–15	45	57.7
16–25	33	42.3
Discharge outcome		
Non-improved	15	19.2
Improved and discharged	63	80.8

CT: Computed tomography

Table 3: Association of factors with treatment (outcome) in COVID-19 patient

Variables	Outcome (treatment)		χ^2	P-value	OR	CI (95%)
	Improved	Not improved				
Sex						
Female	21 (75.0)	7 (25.0)	0.936	1.750	-	-
Male	42 (84.0)	8 (16.0)				
Age						
19–39	16 (100.0)	0 (0.0)	4.805	0.09	-	-
40–59	15 (75.0)	5 (25.0)				
60 or above	32 (76.2)	10 (23.8)				
Blood group						
A	28 (87.5)	4 (12.5)	2.122	0.547	-	-
B	20 (80.0)	5 (20.0)		0.547		
AB	5 (71.4)	2 (28.6)				
O	10 (71.4)	4 (28.6)				
Comorbidities Categories						
No comorbidities	20 (87.0)	3 (13.0)	8.432	0.053	4.286	0.981–18.721
Single comorbidity	29 (90.6)	3 (9.4)		0.014*	6.214	1.452–26.599
Two or more comorbidities	14 (60.9)	9 (39.1)			1	
CT severity score						
1–15	42 (93.3)	3 (6.7)	10.81	0.001*	8.000	03
16–25	21 (63.6)	12 (36.4)			1	

CT: Computed tomography

In our study, we observed that males are more prone to the severity of COVID-19 (64%) than females. The previous studies have shown similar results as.[27] A study conducted in Spain reported that men are more vulnerable than women because of their irresponsible attitude toward the risk of the COVID-19 pandemic.[28] Moreover, a higher resistance in females is observed, which might be due to female sex hormones, whereas men have lower resistance because of the high expression of angiotensin-converting enzyme 2 (ACE2) receptor to which coronavirus binds easily. Studies also showed that ACE2 expression, decreased B cell and NK (Natural killer) cell-specific transcripts, male hormones, and increased nuclear factor kappa light chain enhancer of activated B cells inhibitor are responsible for the higher viral load in men.[27] No significant association was observed between the sex of the patient and treatment outcome, though the improvement rate was found to be higher in males (84.0%) than females (75.0%).

Similarly, it was found that age above 60 (64%) was more prone to COVID-19. The susceptibility to elderly or older people might be due to weak immunity and other organ dysfunctions.[27,29] Many studies have reported that the blood group is a factor for severity of COVID-19. It was observed that blood group A (Rh +ve) was more susceptible to the severity of COVID-19, blood group O (Rh +ve) was associated with a decreased frequency and risk of infection which was also proved by different previous studies as.[15-21,30] Among 78 respondents, 41% have at least one comorbidity as hypertension, diabetes, pneumonia, cardiovascular disease, and kidney diseases. The previous studies have shown at least one comorbidities are more susceptible to the severity of COVID-19 which might be due to a decrease in Innate immunity response, macrophage, and lymphocyte function, which may restrict the body to produce respective antibodies against any infection.[31] The chance of improvement is about 6 times higher (OR-6.214, 95% CI: 1.452–26.599; P=0.014) among patients with single comorbidity compared with patients with two or more comorbidities.

The chest CT can accurately evaluate the type and extent of lung lesions. A previous study reported that a higher CT severity score was related to the inflammatory levels due to diffusion of the virus into the respiratory epithelium, leading to necrotizing bronchitis and diffuse alveolar damage[32] and higher CT severity was a risk factor for progression of patients with COVID-19.[33] It was observed in our study, the chance of improvement is 8 times higher (OR-8, 95% CI: 2.034–31.461; P=0.001) in patients with a CT severity score of 1–15 compared with patients with a CT severity score of 16–25.

There is an urgent need for the discovery of effective antiviral drug and vaccines which could also be derived from processing different natural sources. Different plants consisting flavonoids, phenols, alkaloids, etc., are found to be used traditionally as ethno medicines[34,35] for antiviral properties.[36]

Limitations of the study

This study has some limitations. The study was single centered and done for certain period of time only.

CONCLUSION

CT severity score and pre-existing comorbid condition play an important role among the different associated factors with severity and treatment outcomes of COVID-19 patients. CT score is found to be crucial in the diagnosis and disease severity evaluation of this disease. No significant association was observed in between blood grouping of patients and treatment outcome in this study. Although the number of COVID-19 cases continues to grow worldwide, no specific antiviral treatment has been confirmed to be effective against COVID-19. Hence, clinical and demographical characteristics, clinical manifestation, and comorbidities of COVID-19 patients are more important to early detection and isolation as well as minimize the spread of the disease, severity, and death rate.

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