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Coronavirus Pandemic

A study of long COVID-19 in Duhok, Kurdistan region, Iraq

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Abstract

Introduction: Long COVID-19 refers to a range of symptoms and complications that persist after being infected with COVID-19 or develop some time after recovery. Our study aimed at assessing the prevalence of long COVID-19 in Duhok city, Iraq and its correlation with epidemiological and clinical variables.

Methodology: This cross-sectional study was conducted between March and August 2022. A questionnaire was used for data collection from participants aged 18 and older. The questionnaire included demographic information and clinical data.

Results: Among the 1039 participants, (49.7%) were male with a mean age of 34.048 ± 13 years. Total infected volunteers were 492 (47.4%), out of which 20.7% did not have long COVID-19 and 26.7% had long COVID-19. The most common long COVID-19 manifestations were fatigue (57%), hair loss (39%) and loss/change in the sense of smell or taste (35%). Correlation between the variables gender, comorbidities, age, and duration of infection, and long COVID-19 were significant (p values = 0.016, 0.018, 0.001, and 0.001 respectively).

Conclusions: There was a significant correlation between long COVID-19 cases and age, gender, comorbidities, and duration of infection. The data of this report can be used as a baseline for studies that may help further understand long COVID-19 sequelae.

Key words: COVID-19; long COVID-19; comorbidities; Duhok; Iraq.

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Introduction

Coronavirus disease 2019 (COVID-19), the global pandemic declared by the World Health Organization (WHO) on March 11, 2020, is a highly contagious viral disease caused by a novel coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus is a member of a large family of viruses called coronavirus [1,2]. The virus spread across the globe rapidly resulting in devastating consequences on every person's social, economic, mental and physical health [2]. On March 1st 2020, the first case of COVID-19 was recorded in the Iraqi Kurdistan Region and eventually it spread across the region in spite of the strict prevention measures [3]. The clinical spectrum of COVID-19 can vary: asymptomatic, mild illness, severe respiratory failure, multi-organ failure, and death with a mean incubation period of 5.1 days [2]. Recovery time needed for mild SARS-CoV-2 infection usually extends between 7–10 days after the onset of symptoms and it may take up to 3–6 weeks in severe/critical cases [4]. Recently, there has been increased awareness about the long-term outcomes of COVID-19 infection which is informally called long-COVID syndrome [5]. Long COVID syndrome is also known by the terms long-COVID-19, long haulers, and post COVID-19 syndrome [6,7]. In general, it refers to the persistent, recurrent, or new symptoms and complications that continue after four weeks of recovery from COVID-19 infection. In this case, although the patient tests negative with the SARS-CoV-2 PCR indicating microbiological recovery, he/she is still not clinically recovered [5,8,9,7]. The exact mechanism behind this has not been defined yet, many theories have been suggested including sequelae of organ damage, sequelae of critical illness, complications of infection, re-infection, and relapse. Psychological factors like post-traumatic stress may also contribute to the development of symptoms. The most common symptoms reported include fatigue, headache, attention disorders, hair loss, and dyspnea [4]. Other symptoms that may be present are chest pain, palpitation, anosmia, dysgeusia, cough, ear pain, rhinorrhea, nausea, loss of appetite, arthralgia, myalgia, memory loss, inability to concentrate (brain fog), insomnia, mood change,

paresthesia, headache and red eyes [10]. In this study, we aimed to evaluate the prevalence of long COVID-19 in Duhok city, Iraq and its correlation with different variables.

Methodology

Study design and sample collection

This cross-sectional study was conducted between March and August 2022 in Duhok city; Kurdistan Region of Iraq. Data collection was carried out in major health facilities in the city. Since there was no recorded data regarding the prevalence of long COVID-19 in this region, a prevalence of 50% was estimated and used in the calculation of sample size. The sample size was calculated to be 883 subjects using a confidence interval of 95% (standard value = 1.96), margin of error of 0.05, design effect of 2 and expected participation rate of 0.85. We interviewed 1039 individuals. Participants younger than 18 years of age and those who did not give consent were excluded. Participants were asked to participate voluntarily and were interviewed face to face with a questionnaire.

Questionnaire

A questionnaire was designed to include socio-demographic and clinical data. The data included age, gender, occupation, smoking status, preexisting comorbidities, type of comorbidities, vaccination history, duration of COVID-19 infection, symptoms and type of treatment given.

The severity of symptoms of COVID-19 was classified into (0. Mild; 1. Moderate; 2. Severe; 3. Critical) [11,12]. Mild cases were defined as no symptoms or sign of pneumonia and normal imaging, whereas, the presence of symptoms and signs of pneumonia with a positive imaging for pneumonia, normal respiratory rate and oxygen saturation of 93-95% at rest was classified as moderate. Further, if participants had radiological evidence of pneumonia in addition to respiratory distress, oxygen saturation of ≤ 93% at rest, or arterial partial pressure of oxygen (PaO_2)/fraction of inspired oxygen (FiO_2) ≤ 300 mmHg (1 mmHg = 0.133 kPa), they were defined as severe cases. The participants were asked about the presence of specific symptoms associated with COVID-19 during the period of infection and after 4 weeks from infection. They were given the option to add any other symptom not included in the questionnaire. Additionally, participants were questioned about the presence of a gap between developing long COVID-19 and recovering from COVID-19.

Definitions

The study participants were defined based on symptoms and their duration and, real time reverse transcriptase polymerase chain reaction (RT-PCR) test.

Participants were categorized into no COVID-19 infection, COVID-19 infection without developing long COVID-19, and COVID-19 with developing long COVID patients. The 'no COVID-19' group included participants who never had a positive SARS-CoV-2 RT-PCR test. COVID-19 without long COVID-19 group were participants who had a positive SARS-CoV-2 RT-PCR test before regardless of the presence of symptoms and did not have long COVID-19 symptoms. COVID-19 with long COVID-19 group included participants who had a positive SARS-CoV-2 polymerase chain reaction (PCR) test and had persistent, recurrent, or new symptoms that continued after 4 weeks of COVID-19 infection and were not interrupted by an alternative diagnosis [13].

COVID-19 infection of participants who were included in the study was confirmed by using RT-PCR test according to the protocol followed locally. Two sets of primers were used for identification of SARS-CoV-2 virus in two separate reactions that targeted two different conserved regions. The first reaction targeted the conserved region of the E-gene (76 bp) using LightMix Modular SARS Wuhan CoV E-gene (TIB Molbiol, Berlin, Germany). The second reaction targeted a 100 bp long fragment from a conserved region of the RNA-dependent RNA polymerase (RdRP) gene using LightMix Modular Wuhan CoV RdRPgene (TIB Molbiol, Berlin, Germany). The test was considered positive if the results of both reactions were positive, whereas, the test was considered negative if the outcomes of both reactions were negative. If one of the reactions was positive and the other negative, the results were deemed invalid [11].

Statistics

The data analysis was performed using the Minitab software version 17. The results were presented in terms of the mean, standard deviation (SD) values, odds ratio (OR), standard error (SE) and confidence intervals of 95% (CI 95%). Logistic regression analysis was used to evaluate the association between long COVID-19 prevalence and the different variables that may increase its prevalence. The Chi-square and E-tests were used for the analytical assessment and p values of ≤ 0.05 were considered statistically significant.

Ethics

The study was approved by the Scientific Committee of the University of Zakho, College of Medicine (UoZEC 2022/23). Verbal consent was obtained from each participant prior to answering the questionnaire.

Results

Characteristics of participants

The study was conducted on a total of 1039 participants of which 516 (49.7%) were male and 523 (50.3%) were female. The mean age was 34.048 ± 13 years (Table 1).

Characteristics of participants that were infected with COVID-19

Of the 1039 participants we interviewed, 492 (47.35%) were infected with COVID-19. Their characteristics are shown in Table 2.

Characteristics of participants with long COVID-19

Long COVID-19 was reported by 277/492 (56.3%) participants with COVID-19 infection in this study and its prevalence among total study participants was 26.7%. The characteristics of this group are shown in Table 3.

Clinical features of participants infected with COVID-19

Table 4 presents the prevalence of symptoms related to COVID-19 and long COVID-19. Fatigue was the most common symptom in both COVID-19 and long COVID-19. Other long COVID-19 manifestations were hair loss (n = 109, 39%), loss/change in the sense of smell or taste (n = 97,35%), joint or muscle pain (n = 79, 28.5%), cough (n = 74, 26.7%), problems with memory or concentration (n = 68, 24.5%) and post-exertional malaise / poor endurance (n = 65, 23.5%).

Correlation between different variables and long COVID-19

The COVID-19 cases were classified according to their severity into mild, moderate, severe and critical. There was a significant correlation between COVID-19 and long COVID-19 cases based on the severity (*p* value = 0.001). The majority of the COVID-19 cases were moderate (n = 219), followed by mild (n = 195), severe (n = 74) and critical (n = 4). Similarly, the majority of long COVID-19 cases were moderate (n = 139), followed by mild (n = 73), severe (n = 61) and critical (n = 4). Correlations between different the variables gender, comorbidities, age, and duration of infection, and long COVID-19 were significant (*p* values = 0.016, 0.018, 0.001, 0.001 respectively) (Tables 5 and 6).

Table 1. Characteristics of all participants.

Characteristics	n (%)
Age (mean/SD)	34.048 /13
Gender	
Male	516 (49.7)
Female	523 (50.3)
Uninfected with COVID-19	547 (52.65)
Infected without long COVID	215 (20.7)
Infected with long COVID-19	277 (26.7)

SD: Standard Deviation.

Table 2. Characteristics of participants who were infected with COVID-19.

Characteristics	n (%)
Age (mean/SD)	22.62 /12.92
Gender	
Male	254 (51.6)
Female	238 (48.4)
Comorbidities	
Present	108 (22)
Absent	384 (78)
Severity of symptoms	
Mild	195 (40%)
Moderate	219 (45%)
Severe	74 (15%)
Critical	4 (0.01%)
Duration of symptoms (mean /SD)	10.15 /6.32

SD: Standard Deviation.

Table 3. Characteristics of participants who developed long COVID-19.

Characteristics	n (%)
Age (mean/SD)	37.285/14.2
Gender	
Male	118 (42.6)
Female	159 (57.4)
Comorbidities	
Present	82 (29.6)
Absent	195 (70.4)
Severity of symptoms	
Mild	73 (26.3)
Moderate	139 (50)
Severe	61 (22)
Critical	4 (1)
Duration of symptoms of long COVID-19 (months) (mean /SD)	6.1 /6.6

SD: Standard Deviation.

Table 4. Clinical features of COVID-19 and long COVID-19.

Symptoms	During infection n (%)	Long COVID n (%)
Fatigue	444 (90)	158 (57)
Post-exertional malaise / poor endurance	242 (49.2)	65 (23.5)
High temperature	424 (86.2)	6 (2)
Loss/change in the sense of smell or taste	351 (71.3)	97 (35)
Hair loss	132 (26.8)	109 (39)
Problems with memory or concentration	127 (26)	68 (24.5)
Difficulty sleeping	212 (43)	19 (7)
Dizziness	210 (42.7)	22 (8)
Headache	377 (76.6)	23 (8.3)
Mood changes	178 (36)	19 (7)
Dyspnea	162 (33)	35 (12.6)
Palpitation	133 (27)	20 (7)
Cough	311 (63.2)	74 (26.7)
Chest pain	161 (32.7)	26 (9.4)
Pins and needle	99 (20)	12 (4)
Joint or muscle pain	347 (70.5)	79 (28.5)
Menstrual irregularities	18 (3.6)	15 (5.4)
Rhinorrhea	127 (25.8)	1 (0.4)
Loss of appetite	324 (66)	22 (8)
Red eyes	93 (19)	6 (2)
Change in bowel habit	125 (25.4)	4 (1.4)
Abdominal pain	92 (18.7)	4 (1.4)

Table 5. Correlation between different variables and long COVID-19.

Variable	No. of infected cases with COVID-19	No. of infected cases with long COVID-19	*p* value	OR	CI
Gender					
Male	254	118	0.016	1.44	1.07-1.93
Female	238	159			
Smoking					
Yes	193	118	0.36	0.87	0.64-1.17
No	299	159			
Comorbidities					
Yes	108	82	0.018	0.67	0.48-0.93
No	384	195			
History of COVID-19 vaccination					
Yes	61	28	0.34	1.26	0.78-2.02
No	431	249			

OR: Odd Ratio; CI: Confidence Intervals.

Table 6. Association between age or duration and long COVID-19 using *t*-test.

Variables	Mean	StDev	SE Mean	*p* value	CI
Age					
long COVID-19	37.3	14.2	0.85	0.001	4.43-9.01
COVID-19	30.6	11.7	0.8		
Duration					
long COVID-19	13.05	7.28	0.44	0.001	4.69-6.93
COVID-19	7.24	5.36	0.37		

SD: Standard Deviation SE: Standard Error.

Discussion

With the increase in the number of patients who have recovered from COVID-19, data on the post-acute COVID-19 symptoms and complications are now available. Long COVID-19 is defined as the continuity, recurrence, or development of new symptoms after 4 weeks of recovery from COVID-19 and without interruption by an alternative diagnosis [5,7,8]. Although numerous studies have been conducted in Kurdistan region after the outbreak of COVID-19 regarding the prevalence, prognosis, psychological impact, and several other aspects of COVID-19, there is lack of data about the prevalence of long COVID-19 [14-17]. To the best of our knowledge this is the first cross-sectional study in the literature to evaluate the prevalence of long COVID-19 among Kurdistan-Duhok population. Based on our results, 1 out of 2 people infected with COVID-19 will develop long COVID-19.

In this study, the positivity rate of COVID-19 was 56.3%. Among them, 26.7% of participants who contracted the infection developed long COVID-19. Comparably, the prevalence of long COVID-19 cases was 60% in a cross-sectional study conducted in Basra City-Southern of Iraq [18] and 62.3% in a retrospective, uncontrolled and observational cohort study in Iran [19]. However, meta-analysis and systematic review which analyzed 41 studies stated that the global prevalence of long COVID-19 was 43%, with wide variation among the included studies from 9% to 81% [14]. This variation in the prevalence might be due to the population studied, different variants of the virus affecting the region and genetics of the participants.

The prevalence of long COVID-19 was higher in females than males. We found a significant association between gender and long COVID-19. Similar observations have also been reported in literature [18,20-22]. In contrast, some other studies found no significant association between female gender and the risk of developing long COVID-19 [23,24]. The higher proportion of females with long COVID-19 could be due to higher level of stress among them, their genetic makeup, or hormonal changes.

Age was also identified as a potential risk factor associated with increased long COVID-19. Our findings were in agreement with studies which claimed that age was a significant risk factor for long COVID-19 [18,23,25,26]. This may be due to the weak immune system associated with increasing age.

We found a significant association between long COVID-19 and comorbidities. This was in agreement with a study conducted in Karachi, Pakistan [27]. Similarly, in Norway, it was found that the association was solely related to existence of chronic lung diseases such as asthma [28], In contrast, the results of a study conducted in Spain stated that patients with chronic diseases such as asthma had a lower rate of persistence symptoms of COVID-19, and were consequently less prone to develop long COVID-19 [29]. However, other studies did not find any correlation between long COVID-19 and preexistence of comorbidities [18,19,22]. Our results are difficult to explain and further research is needed to assess this correlation.

In spite of the fact that the spectrum of long COVID-19 symptoms is extensive, fatigue has been widely mentioned in literature as the most common symptom [7,10,30,31]. Similarly, fatigue was the most common symptom in our study.

Limitations of the study

Although our sample size was big, nearly half of participants reported that they were not infected with COVID-19. The high prevalence of non-infected participants may not reflect the actual prevalence of COVID-19 infection in this region since COVID-19 continues to be perceived as a stigma among the population.

Conclusions

Long COVID-19 was found prevalent in the region with various clinical manifestations. The most common symptoms among long COVID-19 cases were fatigue, hair loss, loss/change in the sense of smell or taste, joint or muscle pain, and cough. Significant correlation was found between long COVID-19 and variables such as gender, comorbidities, age, and duration of infection. This is the first report about the prevalence of long COVID-19 in the region that may provide a better understanding of post-COVID-19 sequelae. Further research is needed for complete understanding of the concepts of long-COVID-19.

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Authors' contributions

All authors read and approved the final manuscript. SSA: conducted the sample collection, interviewing participants, data analysis and writing original manuscript draft; PIA: sample collection, interviewing participants, data analysis and writing original manuscript draft; NAR: writing original manuscript draft, manuscript reviewing and editing; NRH:

manuscript editing, reviewing, and supervising the work; KD: reviewing and editing the final draft of manuscript.

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