

Clinical-demographic characteristics of patients recovered from COVID-19 in a third level rehabilitation unit

Características clínico-demográficas de pacientes recuperados de COVID-19 en una unidad de rehabilitación de tercer nivel

Clara L. Varela-Tapia^{1*}, Daniel Martínez-Barro², Paola M. Moreno-Pesquera¹, Hermelinda Hernández-Amaro³, Valeska Dorado-Arias¹, Janelly Peñaloza-Juárez¹, and Nallely Contreras-Del Carmen¹

¹Cardiac Rehabilitation Department, Physical Medicine and Rehabilitation North Unit, High Specialty Medical Unit (Unidad Médica de Alta Especialidad, UMAE) Traumatology, Orthopedics and Rehabilitation Dr. Victorio de la Fuente Narváez, Mexico City; ²Rehabilitation Department, Regional General Hospital N. 6 Ignacio García Téllez, Madero City, Tamaulipas; ³Health Education and Research Department, Physical Medicine and Rehabilitation North Unit, UMAE Traumatology, Orthopedics and Rehabilitation Dr. Victorio de la Fuente Narváez, Mexico City. Mexico

Abstract

Objective: To determine the clinical-demographic characteristics of patients recovered from COVID-19 in a third level rehabilitation service. **Method:** A cross-sectional and descriptive study of recovered COVID-19 patients in a rehabilitation service was carried out. Demographic, personal pathological history, his work activity and COVID-19 were taken, as well as alterations after the disease. Descriptive statistics were performed. **Results:** 186 files were collected. The mean age was 48.04 ± 11.32 years. Male predominance was found (65.6%). 50% of the patients were health workers. The most common previous pathological conditions were sedentary lifestyle (73.7%) and diabetes mellitus (29%). 43.5% presented grade 3 dyspnea according to the modified Medical Research Council scale. There was a high prevalence of neuromuscular involvement, predominantly peripheral neuropathy (48.4%) and dysautonomia (46.2%). **Conclusions:** It was possible to determine the clinical-demographic characteristics of patients recovered from COVID-19 in a third-level rehabilitation service, such as age, sex, type of work, previous pathological conditions (diabetes mellitus and arterial hypertension), body mass index, dyspnea, hospitalization, and post-illness disorders. Further investigation of COVID-19 is needed in the development of conditions to different systems.

Keywords: Rehabilitation. COVID-19. Clinical-demographic characteristics.

Resumen

Objetivo: Determinar las características clínico-demográficas de pacientes recuperados de COVID-19 en un servicio de rehabilitación de tercer nivel. **Método:** Se realizó un estudio transversal y descriptivo de pacientes recuperados de COVID-19 en un servicio de rehabilitación. Se tomaron antecedentes demográficos, personales patológicos, de su actividad laboral y de COVID-19, así como alteraciones posteriores a la enfermedad. Se realizó estadística descriptiva. **Resultados:** Se recolectaron 186 expedientes. La edad media fue de 48.04 ± 11.32 años. Se encontró predominio del sexo masculino (65.6%). El 50% de los pacientes eran trabajadores de la salud. Las condiciones patológicas previas más comunes fueron sedentarismo (73.7%) y diabetes mellitus (29%). El 43.5% presentaron disnea de grado 3 acorde a la escala Medical Research Council modificada. Existió alta prevalencia de compromiso neuromuscular, predominando la neuropatía periférica (48.4%) y la disautonomía (46.2%).

*Correspondence:

Clara L. Varela-Tapia
E-mail: vclaralilia@yahoo.com.mx

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Conclusiones: *Se logró determinar las características clínico-demográficas de pacientes recuperados de COVID-19 en un servicio de rehabilitación de tercer nivel, como la edad, el sexo, el tipo de trabajo, las condiciones patológicas previas (diabetes mellitus e hipertensión arterial), el índice de masa corporal, la disnea, la hospitalización y las alteraciones posteriores a la enfermedad. Es necesaria mayor investigación de la COVID-19 en el desarrollo de afecciones en diferentes sistemas.*

Palabras clave: *Rehabilitación. COVID-19. Características clínico-demográficas.*

Introduction

COVID-19 is a respiratory tract disease caused by a new beta coronavirus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)¹. As of February 2020, 67,530,912 cases of coronavirus have been reported worldwide, as well as 1,545,140 deaths. In Mexico, as of the same date, there are 1,193,255 accumulated cases, 54,131 active cases and 110,874 deaths². Angiotensin-converting enzyme 2 (ACE2) has been identified as an entry receptor for SARS-CoV-2, which is transmitted via small-caliber droplets that directly infect nasal ciliated and alveolar epithelial cells. ACE2 is also expressed in the small intestine, kidneys, heart, thyroid, nervous system, testes and adipose tissue¹.

Rehabilitation is a key pillar in maximizing the recovery of patients post-COVID-19 and in maintaining function for those with chronic disease³.

Throughout the course of the COVID-19 pandemic, the need for knowledge of the regional clinical-demographic characteristics of the patients affected by it emerged, as it constitutes useful information to have a better understanding of the phenomenon and to adapt the cardiopulmonary rehabilitation programs in order to provide comprehensive management to the patient recovered from COVID-19.

Studies have been conducted in third level care centers, where the clinical-demographic characteristics of patients with acute stage COVID-19 have been described⁴. However, to our knowledge, the clinical-demographic characteristics of patients treated in rehabilitation centers in our country have not been reported. Therefore, there is a need to know what are the clinical-demographic characteristics of COVID-19 recovered patients from a rehabilitation center.

The previous hypothesis was that the clinical-demographic characteristics of patients who had COVID-19 would be different from those found in previous studies, considering that patients are served at a different stage of the natural evolution of the disease or clinical care, as well as in a different geographic region. Therefore, the objective of this study is to describe this information in a third level rehabilitation center.

Method

A cross-sectional, observational and descriptive study was conducted on patients recovered from COVID-19 at the Physical Medicine and Rehabilitation North Unit of the Mexican Institute of Social Security (Instituto Mexicano del Seguro Social, IMSS) during the period from July 2020 to January 2021. The records of IMSS beneficiaries referred to the cardiac and pulmonary rehabilitation service with a diagnosis of mild to severe COVID-19 were included. The search for files was carried out and those with complete information were selected. Age, sex, place of residence, work activity, personal pathological history, aspects related to COVID-19 and alterations detected after recovery from this disease were recorded. The records were entered into a database. A total of 186 files were obtained. The sample size was calculated using the formula for estimating a proportion for an infinite population, with a confidence level of 95%, a precision of 5% and a proportion of 0.5. Taking into account a loss percentage of 10%, this gave a total of 427 files.

Statistical analysis was performed with the IBM SPSS *software* version 25. Quantitative variables were subjected to normality tests and presented in measures of central tendency and dispersion, according to their distribution. Qualitative data are presented as percentages. The scientific and bioethics committee has authorized the study to be carried out.

Results

A total of 186 files that met the selection criteria were collected. The mean age of the patients was 48.04 ± 11.32 years (Table 1). There was a predominance of the male sex (65.6%). The most common place of residence was in the Valley of Mexico (57.5% in Mexico City and 31.2% in the State of Mexico). Most of them had temporary incapacity for work (62.4%). 22% of the patients continued with their work despite being in a rehabilitation service. 50% were health care personnel. Sedentary lifestyle (73.7%), diabetes *mellitus* (29%) and systemic arterial hypertension (28%) were the most

Table 1. Clinical-demographic characteristics of patients after COVID-19 in a third level rehabilitation unit (n = 186)

Characteristics	
Age (mean, SD)	48.04 (11.32)
Men (n, %)	122 (65.6)
Place of residence (n, %)	
Mexico City	107 (57.5)
State of Mexico	58 (31.2)
Unknown	19 (10.2)
Foreign	2 (1.1)
Employment status (n, %)	
Disabled	116 (62.4)
Working	41 (22)
Beneficiary	13 (7)
On leave	8 (4.3)
Pensioner	4 (2.2)
Does not work	4 (2.2)
Type of employment (n, %)	
Non IMSS company	
Health personnel	93 (50)
Non-family doctor	20 (10.8)
Nursing	19 (10.2)
Administrative	8 (4.3)
Hygiene	7 (3.8)
Family physician	4 (2.2)
Medical assistant	3 (1.6)
Other	28 (15.1)
Previous pathological conditions (n, %)	
Sedentary lifestyle	137 (73.7)
Diabetes mellitus	54 (29)
Systemic arterial hypertension	52 (28)
No pathological conditions	13 (7)
Other	12 (6.5)
Chronic obstructive pulmonary disease	4 (2.2)
Asthma	4 (2.2)
BMI prior to COVID-19 (n, %)	
Normal	25 (13.4)
Overweight	59 (31.7)
Obesity grade I	54 (29)
Obesity grade II	30 (16.1)
Obesity grade III	6 (3.2)
Obesity grade IV	12 (6.5)
Aspects related to COVID-19 (n, %)	
Hospitalization	112 (60.2)
Home oxygen at hospital discharge	77 (41.4)
Home oxygen with home management	66 (35.5)
Orotracheal intubation	33 (17.7)
Modified MRC dyspnea scale	
Not assessable	17 (9.1)
Grade 1	19 (10.2)
Grade 2	50 (26.9)
Grade 3	81 (43.5)
Grade 4	9 (4.8)
Alterations detected after COVID-19 (n, %)	
Neuromuscular	63 (33.9)
No neurological involvement	90 (48.4)

(Continues)

Table 1. Clinical-demographic characteristics of patients after COVID-19 in a third level rehabilitation unit (n = 186) (continued)

Characteristics	
No neurological involvement	63 (33.9)
Peripheral neuropathy	90 (48.4)
Symptoms of dysautonomia	86 (46.2)
Cerebral vascular event	12 (6.5)
Myoclonus	1 (0.5)
Cardiovascular	
No cardiovascular involvement	174 (93.5)
Pericardial effusion	3 (1.6)
Cardiac arrhythmia	3 (1.6)
Ischemia	2 (1.1)
Bradycardia	1 (0.5)
Pericarditis	1 (0.5)
Other	
Memory impairment	70 (37.6)
Insomnia	88 (47.3)
Dependence in activities of daily living	29 (15.6)

SD: standard deviation; BMI: body mass index; MRC: Medical Research Council.

prevalent conditions in the medical history. 86.4% were overweight/obese. 60% received hospital care, with the need for advanced airway management in 17.7% of the patient total. 43.5% presented grade 3 dyspnea, according to the modified Medical Research Council (MRC) scale.

On admission to the rehabilitation unit we found that 66.1% of the patients had various neuromuscular alterations. Many of the patients presented peripheral neuropathy (48.4%) and dysautonomia-suggestive data (46.2%); in many cases, both at the same time. There was less evidence of involvement of the cardiovascular system, with isolated cases of pericardial effusion, arrhythmias, ischemia, etc.

Finally, more than one third of the patients (37.6%) had memory impairment. Insomnia was reported by 47.3%. The overall condition of 15.6% of the patients caused them to present dependence in activities of daily living.

Discussion

In a study conducted by Suárez et al.⁵ a higher incidence of COVID-19 was reported in males (58.18%). This contrasts with our study, in which 122 (65.6%) patients were found to be male. Genetic and hormonal factors have been observed for sex differences in susceptibility to COVID-19⁶. It has been reported that women are less susceptible to viral infections due to their X chromosomes and sex hormones⁶. There are also sex differences due to exposure to certain risk

factors, such as the cases that were reported in the Wuhan market at the beginning of the pandemic, where the male sex predominated, probably for work-related reasons. It should also be considered that men have more risk behaviors, such as smoking⁶. Differences in susceptibilities related to genetic, hormonal factors and risk behaviors could explain the higher proportion of men compared to women in our study.

Liu et al.⁷ reported in their study that the ages of patients with COVID-19 present two peaks, the first approximately from the fourth to fifth decades of life and the second in the seventh. The average age of the patients was 46 years. Of the 12,656 confirmed cases, the largest number of those infected were in the 30-59 age range (65.85%)⁵. These data are consistent with the mean age reported in our study, which was 48.04 ± 11.32 years.

Patients aged 60 years or older showed clinical manifestations of greater severity and a more prolonged course of the disease compared to those younger than 60 years⁷. According to the World Health Organization, in February 2021, the age range most affected in Mexico in terms of confirmed cases is 30-49 years of age, and in terms of deaths, the group over 70 years of age is the predominant one⁸. These facts could explain the age behavior of our population; the high number of deaths would determine the increase in the proportion of young patients surviving COVID-19.

We observed that most of the patients in our study are disabled workers, with 62.4%. This is a relevant aspect since it has been previously recognized that work activity is a key factor in the risk of infection⁹. According to data on compensation in Italy, SARS-CoV-2 infection is reported to have been acquired in the workplace in 19.4% of cases⁹. In the absence of preventive measures, jobs that require physical proximity between people, indoors, in transportation or in shared places are the most exposed to COVID-19 infection¹⁰. Therefore, health care workers are especially susceptible, which is consistent with what we reported in our study, since clinical care involves physical proximity to SARS-CoV-2 infected patients.

In addition to the risks inherent in the job, healthcare professionals are under constant and increasing stress, with high workloads and emerging mental health problems¹¹. This increases the need for further study in order to understand the phenomenon and implement necessary corrective actions at the work sites. Work environments in packaging, food processing, factories, manufacturing and office jobs have also been associated with increased risk of COVID-19¹⁰.

The proportion of patients working in the health area represents half of the population assisted in this rehabilitation service, which highlights the importance of addressing this issue in greater depth in future research in order to reduce the risk of infection due to the specific work activity. The use of telemedicine and online resources are innovative methods that should be studied in the clinical setting as a safe alternative for communication in medical practice. However, more research is needed in this area.

The use of air conditioning is a common practice in many workplaces. There is now evidence of SARS-CoV-2 transmission through these systems¹², so the relationship between heating, ventilation and air conditioning systems with COVID-19 takes on greater relevance. Proof of this is the review by Marcone¹³, which offers different strategies that can be used to reduce the risks of infection in air-conditioned work environments. These are aspects that could be verified in the workplace as a further measure to reduce transmission.

There are infection risk assessment models, which are focused on quantifying the vulnerabilities associated with a worker's demographic variables and comorbidity to predict the risk of presenting a serious disease⁹. Accordingly, measures have been taken to protect these at-risk groups. However, when observing a high percentage of health personnel, we could conclude that these models are still susceptible to improvements so as to obtain optimal results.

Regarding previous pathological conditions, in the studies by Piquet et al.¹⁴, Curci et al.¹⁵ and Puchner et al.¹⁶, cardiovascular diseases accounted for the highest percentage of cases (49%, 62.5% and 48%, respectively), contrasting with the population in our study, in which they were in the third place (28%), below sedentary lifestyle (73.7%) and diabetes *mellitus* (29%), probably because their patients had an older mean age compared with the mean age in our study, which would increase the prevalence of cardiovascular diseases with respect to diabetes *mellitus* and arterial hypertension.

Piquet et al.¹⁴ and Puchner et al.¹⁶ reported diabetes as second in frequency (29% and 26%, respectively), and Curci et al.¹⁵ reported it as third (18.8%), below tumor diseases (28.12%). These changes may probably be secondary to the age difference among the populations.

Regarding pulmonary pathologies, the study by Piquet et al.¹⁴ reported no cases, while Curci et al.¹⁵ found a percentage of 22% and Puchner et al.¹⁶ a low percentage similar to the one in our study (6.3% and 2.2%, respectively). The difference found in the study

by Curci et al.¹⁵ may be because their work focused on the characterization of pulmonary function, so the presence of previous pulmonary pathologies was increased due to the selection criteria of that study.

Obesity has shown a significant association with the severity of COVID-19, due to the mechanism of chronic inflammation that occurs in adipose tissue¹⁷. The majority of the population, both in Mexico and in our study, is obese. This has been associated with a higher rate of morbidity and mortality due to COVID-19. Simonnet et al.¹⁸ reported that patients with a body mass index (BMI) > 35 kg/m² had a higher risk of requiring mechanical ventilation, and the group with the lowest probability was that of subjects with a BMI < 25 kg/m². Petrilli et al.¹⁹ related obesity to the need for hospitalization, increased severity of COVID-19 presentation, mechanical ventilation and death. It is important to address the role of obesity in the prevalence of COVID-19 sequelae in future research.

According to reports from the Pan American Health Organization, the number of hospitalizations as of February 8, 2021 was 58,021 (17%), of which 44,992 (78%) patients required endotracheal intubation and 100% were admitted to an intensive care unit⁸. In most cases (81%), COVID-19 is a mild disease with fever (88.7%), cough (57.6%) and dyspnea (45.6%). It is likely that the patients who were seen in this rehabilitation unit had mild to moderate symptoms, with a low need for orotracheal intubation.

Dyspnea is one of the most frequently reported symptoms, reaching 65% of the cases. The instrument of choice for its quantification, in most studies, has been the modified MRC scale. Its application is recommended regardless of the degree of severity²⁰. More than 90% of the patients presented dyspnea, predominantly grade 3 (43.5%).

The ACE2 receptor is present on glial cells, neurons, endothelial cells and smooth muscle cells. The interaction of the virus and this receptor can initiate a cycle of viral growth with secondary neuronal damage without substantial inflammation, as occurs with SARS-CoV²¹. The aforementioned is consistent with the findings in our population, with a high percentage of patients with peripheral neuropathy, dysautonomia and cerebral vascular event. The changes have already been evidenced electroneuromyographically, as reported by Daia et al.²², who found conduction block, prolonged motor latencies and F-wave alterations, suggesting demyelinating damage by SARS-CoV-2. There is evidence of direct damage of COVID-19 on muscle fibers by the short duration and low amplitude

of the motor unit action potential, as well as early recruitment during the needle electrode study²². On the other hand, it should be taken into account that patients with COVID-19 may develop compressive neuropathies, due to prolonged positioning in intensive care units. Serrano Barrenechea et al.²³ reported the case of a patient with meralgia paresthetica following prone position in the intensive care unit due to COVID-19. In order to clarify the origin of the neuropathy, it is suggested to perform an individual assessment in each case.

The neurotropism of SARS-CoV-2 has been documented in multiple reports. The autonomous system has also shown alterations. Ghosh et al.²⁴ made a case report of a 20-year-old man, with no significant pathological history, who had a clinical and laboratory diagnosis of COVID-19, in which they found a decrease in heart rate variability with the Valsalva maneuver. Further research is needed to determine the effects of COVID-19 on the autonomic nervous system and its impact on the rehabilitation process, quality of life, and occupational and social reincorporation, since a high proportion of patients in our study presented data suggestive of damage to the cardiac autonomic system (46.2%).

Multiple cases of Guillain-Barré syndrome related to COVID-19 have been reported²⁵, with a higher prevalence of the classic sensorimotor form and rare variants such as Miller-Fisher. Although the relationship of COVID-19 with cerebrovascular disease is still unclear, there are multiple case reports in which the cerebral vascular event has been found to be a complication. In the systematic review by Nannoni et al.²⁶, which included 108,571 patients with COVID-19, a cerebral vascular event was observed in 1.4%, which was lower than the percentage found in our work (6.5%). This is probably due to the fact that those patients with major complications, including cerebral vascular events, are sent to our third level rehabilitation center.

Acute cardiac injury occurs in approximately 8-12% of all patients²⁷. In our study we found two patients with this history, possibly because we had not systematically performed paraclinical studies to demonstrate this and other cardiovascular alterations. More research is needed in this area, as there are currently no such studies.

Patients who have had COVID-19 have presented alterations in memory, attention and emotions. In our study, a total of 70 patients were found to have memory impairment, which corresponds to 37.6% of the population studied. Woo et al.²⁸ found deficits in

short-term memory in 18.9%, and in attention and concentration in 19.9%, despite having mild uncomplicated disease. In our study, a large number of patients recovered from COVID-19 was affected in terms of memory impairment, while there are similar studies supporting this finding. The importance of performing a cognitive assessment when caring for these patients should be emphasized. A large part of the population is composed of older adults, who potentially present undiagnosed cognitive alterations, making the picture of deterioration after recovery from COVID-19 more severe. This factor should be taken into account for the prognosis in the cognitive area.

The association with insomnia has been related to depression and anxiety. In our population, 88 patients were found to have insomnia, which corresponds to 47.3%. Wang et al.²⁹ reported that, of a total of 484 patients hospitalized for COVID-19, 42.8% had insomnia; most were women and had periods of anxiety, depression and significant fatigue. It was also related to isolation given that, as reported by Bo et al.³⁰, this leads to depression, anxiety, anger, uncertainty, loneliness and post-traumatic stress. It is relevant to pay special attention to this area since, observing the results of the study, almost half of these patients presented insomnia, which may have an impact on their recovery, and may complement the multidisciplinary approach through the psychology service.

Among the patients affected by COVID-19, in our population there were 29 patients with repercussions on activities of daily living, corresponding to 15.6%. Belli et al.³¹, when applying the Barthel Index for activities of daily living in patients coming from hospitalization prior to their admission to a rehabilitation center, found a decrease in the score of this index (< 60 points) and even 47.5% of the discharged patients presented a low score in the items of mobility, climbing and descending steps, transfers and toilet use³¹. In a systematic review by Hopkins et al.³² on patients who had a critical illness requiring care in the intensive care unit, it was found that in 69% of all the included articles, patients became dependent or worsened their activities of daily living. However, this dependency decreased during the follow-up period. In patients who presented COVID-19 and required hospitalization, a greater degree of dependence in activities of daily living is found, and for this reason we should focus on recovering these activities by means of adequate rehabilitation treatment. It is worth mentioning that our unit has support personnel for psychological comorbidity care.

Limitations

Among the limitations of this study, it should be mentioned that we do not have data on the specialties and area of work of the physicians, the smoking rate or the number of patients who had insomnia and depression before the study. It is recommended that these variables be taken into account in future studies in order to calculate their association with COVID-19 sequelae.

Conclusions

The present study succeeded in determining the clinical-demographic characteristics of patients recovered from COVID-19 in a third level rehabilitation unit, such as age, sex, type of work, previous pathological conditions (diabetes *mellitus* and arterial hypertension), BMI, dyspnea, hospitalization and post-disease alterations. This description will be useful in a clinical setting, since by knowing the characteristics, it will be possible to make adjustments in the rehabilitation process to maximize its benefits. It is evident that COVID-19 disease not only affects the lungs, but also affects multiple systems and can leave variable sequelae. Multidisciplinary medical care is necessary for the management of this population. Further research is needed to clarify the role of COVID-19 in the development of cardiovascular, neuromuscular, pulmonary and functional conditions or sequelae, as well as better strategies to prevent infection in the workplace, especially among healthcare workers.

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Conflicts of interest

The authors state they have no conflicts of interest.

Ethical disclosures

Protection of people and animals. The authors declare that no experiments were carried out on humans or animals for this research.

Data confidentiality. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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