Use of the Barthel index to assess activities of daily living before and after SARS-COVID 19 infection of institutionalized nursing home patients

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 doi:10.20944/preprints202105.0612.v1

Objective:
The objective of the present study was to evaluate the activities of daily living using the Barthel Index, before and after the infection by SARS-COV-2 and to see if the results vary according to sex.
Methods:
The activities of daily living of 68 cohabiting geriatric patients, 34 men and 34 women, in 2 nursing homes were measured before and after SARS-COV-2 infection using the Barthel index.
Results:
The Covid 19 infection affects the performance of daily life activities in institutionalized elderly in nursing homes, and it does so especially the older the subject, regardless of sex.
Conclusions:
The Covid 19 pandemic, in addition to having claimed some victims, especially in the elderly population, has reduced the ability of these people to carry out their activities of daily life, considerably worsening their quality of life despite have been able to overcome the disease.

Key words:
Activities of daily living; Barthel index; SARS-COV-2

 doi:10.20944/preprints202105.0612.v1

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a positive sense, enveloped RNA beta coronavirus that emerged in Wuhan, China, in December of 2019 (1). It is the cause of the clinical disease known as COVID-19 that has resulted in more than 50 M infections and more than 1.25 M deaths according to the World Health Organization (2)

In a disease as infectious as COVID-19, host factors are the key to determining the severity and progression of the disease (3). For severe COVID-19 disease, the main risk factors include age, male gender, obesity, smoking, and comorbid chronic diseases such as hypertension, type 2 diabetes mellitus, and others (4–6).

Patients with COVID-19 most commonly report fever, cough, myalgia, fatigue, dyspnea, anosmia, and ageusia (7,8) In some cases, there is a presence of increased sputum production, headache, hemoptysis, diarrhea, and myalgia (9–14) although roughly 20% percent of patients are thought to be truly asymptomatic (15). The average recovery time in mild illness is 2 weeks, while in severe illness it is 3-6 weeks (16). After these weeks of convalescence, rehabilitation is necessary, especially in the elderly population. The goal of rehabilitation in patients with COVID-19 infection is to improve the sensation of dyspnea, relieve anxiety and depression, reduce associated complications, improve functionality, preserve pre-existing functions, and improve quality of life.

After the resolution of the acute phase, physical, emotional and psychological impairments often persist even for a prolonged period and contribute to a complex and multi-factorial disability by requiring continuity of care and a rehabilitative multimodal management (17)(18)(19). As part of the rehabilitation procedures, evaluation of the following items are recommended: functional impairment; deterioration in the performance of activities of daily living (ADL); and social disadvantages evaluated using scales such as the Performance Status, the Barthel Index, and the Functional Independence Measure.(20).

In community-dwelling, older persons screening and assessing the ability to conduct activities of daily living (ADL), such as getting out of bed, toileting, bathing, dressing, grooming, and eating are frequently used. These measures are applied to detect early onset of disability and are key factors for care management (21)

Geriatric assessment using the Barthel index is very important to optimize the care of the elderly patient in a new epidemic outbreak. Therefore, the purpose of this study was to evaluate the ADL in residents before and after suffering the virus, using the Barthel index, to verify if the ADL is decreased after overcoming the infection, which activities were most affected and if it influences the sex of the elderly in the results.

Material and Methods

The type of clinical study carried out was longitudinal prospective cohort, this study was approved by the ethics committee of the San Carlos Clinical Hospital of Madrid with internal code 21/251-E, authorization was requested from the management of the two geriatric residences under study and all patients gave their informed consent before enrolling in the study. From March 2020 to December 2020, 68 residents suffered and overcame the SARS-COV-2 virus, with different degrees and affectations.

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We based our calculations on previous results obtained by Masanori Okamoto et al(22) where they analyzed the Barthel index in patients undergoing surgery diagnosed with benign tumors, comparing them with patients diagnosed and surgically treated with atypical lipomatous tumors, obtaining results of 98.01 ± 0.62 and of 97.08 ± 2.49 respectively, so for a 2-tailed test, with an α level of 0.05, with a 95% confidence interval and a statistical analysis of the desired power. 80% (error β = 20%), a minimum sample size of 59 people is obtained and estimating a loss of 15% a total of 68 people is needed.

The activities of daily living are evaluated in the residents periodically by the nurse using the Barthel index, the Barthel index or Barthel scale is an instrument used in medicine for the functional assessment of a patient.

The scale measures the ability of a person to perform 10 activities of daily life, which are considered basic, in this way a quantitative estimate of their degree of independence is obtained. The scale is also known as the Maryland Disability Index. The patient must be questioned about each of the corresponding activities and a score will be given according to their ability to perform it, I n the case of washing and grooming, it will be 5 points, eating, dressing, deposition, urination, using the toilet and climbing steps will have a maximum score of 10 points, and moving and walking, will have a maximum score of 15 points, so what totally independent residents will have a score of 100, residents with mild dependency will have a score of 91-99 points, moderate dependency is established with a score of 61-90, severe dependency is found in scores ranging from 21 to 60 points, and they are considered total dependent residents when they score 20 points or less (23,24), the Barthel indexes performed a most 3 months before the disease were taken as a reference and the indexes were performed again, maximum 3 months after overcoming the infection and being discharged by the medical team in order to assess whether the degree of dependence had changed.

All the barthel scores were collected in an excel table with the score obtained individually by each participant, in which scores per item and total scores were calculated.

Based on the information from the medical records, we analyzed the following factors: age, sex, height, weight, and body mass index.

This index has been described by many authors as the most widely used to evaluate activities of daily living (ADL) in chronic patients and periodically evaluate their evolution (25–27) the reliability of the test with a Cronbach's alpha of 0.86-0.92 for the original version and 0.90-0.92 for the version proposed by Shah et al (26)

A sample of 68 residents was taken, these were divided into two groups according to sex: men and women. The inclusion criteria followed to develop the study were that the patients were older than 65 years(28), that they lived together in the nursing home and that they had a clinical diagnosis of Covid-19 infection.

The follow-up period was defined as the time that elapsed from before infection by the SARS-COV-2 virus until recovery, taking as values the score obtained before infection and after recovery from it, in a certain period of time to evaluate only the impact on the activities of daily life of the covid 19 and not the possible events that could happen a posteriori or the improvements derived from the rehabilitation.

Statistical Analysis

A descriptive analysis of the characteristics of the participants of both groups was performed. Continuous variables were reported using the mean and standard deviation

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(SD) and range, as well as median, depending on the distribution of data based on the normality test. Shapiro-Wilk.
Independent t student for parametric data. For all analyzes, a value of P <.05 was considered statistically significant. The data obtained was analyzed using SPSS software for Mac (Version 22; IBM Corp, Armonk, NY).

Results

All the variables showed a normal distribution (P > 0.05). There is a significant difference between the age, height and weight of the group of men with respect to the group of women, however, in BMI, there is no significant difference, all these data are shown in Table 1.

Table 1. Demographic and descriptive data of the sample population according to the male group and female group.

Demographic and descriptive data	**Total group N=68** **Mean ± SD (range)**	**Male group n= 34** **Mean ± SD (range)**	**Female group n=34** **Mean ± SD (range)**	**P-value**
Age (years)	85.86±6.42 (84.03-87.69)	84.00±6.06 (81.49-86.50)	87.72±6.34 (85.09-90.34)	0.039
Weight (Kg)	68.52±14.84 (64.30-72.74)	72.76±13.97 (66.99-78.52)	64.28±14.74 (58.19-70.36)	0.042
Height (cm)	168.32±10.85 (165.24-171.40)	175.52±9.04 (171.78-179.25)	161.12±7.11 (158.18-164.05)	0.001
BMI (Kg/m2)	24.07±4.21 (22.87-25.27)	23.54±3.69 (22.01-25.07)	24.59±4.68 (22.65-26.52)	0.384

Abbreviations: BMI, body mass index; SD: standard deviation; range (min–max); Independent t test were used P > 0.05 (with a 95% confidence interval) was considered statistically significant.

As can be seen in Table 2, the results of the Barthel index, before and after suffering the COVID-19 infection, present significant differences in all the items evaluated and in total score.

Table 2. Pre and post covid-19 results of Barthel index.

Variables	**Before COVID19 N =68 Mean ± DS (Range)**	**After COVID19 N =68 Mean ± DS (Range)**	**P-Value**
Eat	10,00±0,00 (10,00-10,00)	8,60±2,48 (7,89-9,31)	<0,001*

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Wash up	3,00±2,67 (2,24-3,76)	1,00±2,02 (0,43-1,57)	<0,001*
Dress	8,10±3,18 (7,20-9,00)	4,48±4,04 (3,65-5,95)	<0,001*
Get ready	4,10±1,94 (3,55-4,65)	3,10±2,45 (2,40-3,80)	<0,001*
Deposition	9,60±1,37 (9,21-9,99)	7,90±3,51 (6,90-8,90)	<0,001*
Urination	8,30±2,60 (7,56-9,04)	5,70±3,91 (4,59-6,81)	<0,001*
Toilet	7,70±4,07 (6,54-8,86)	4,30±4,17 (3,12-5,48)	<0,001*
Transfers	14,50±1,82 (13,98-15,02)	9,00±6,14 (7,25-10,75)	<0,001*
Ambulation	14,50±1,52 (14,07-14,93)	6,60±4,99 (5,18-8,02)	<0,001*
Steps	3,30±4,36 (2,06-4,54)	0,40±1,98 (0,16-0,96)	<0,001*
Total score	83,20±15,20 (78,73-87,67)	52,30±27,22 (44,56-60,04)	<0,001*

Abbreviations: DS: standard deviation; range (min-max) *Paired t test were used P < 0.05 (with a 95% confidence interval) was considered statistically significant.

As can be seen in Table 3, when we compare the results of the Barthel index by sex before suffering the COVID-19 infection, the significant results are those obtained in the transfers and ambulation of women compared to men, with women being the who obtained the worst scoring for both items, however, after having suffered the COVID-19 infection, the difference in ambulation is still significant between both sexes, in this case men obtained worse scores than women, while in transfers there is no longer a significant difference, and urination appears to be significant between men and women, the latter being the ones with the worst scoring, when before suffering the infection it was not.

Table 3. Pre and post covid-19 results of Barthel index by sex.

	Before COVID19 N =68 Mean ± DS (Range)			**After COVID19 N =68 Mean ± DS (Range)**		
Variables	Female	Male	P-Value	Female	Male	P-Value
Eat	10,00±0,00 (10,00-10,00)	10,00±0,00 (10,00-10,00)	1,00	8,60±2,29 (7,65-9,54)	18,6±2,70 (7,48-9,71)	0,500

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Wash up	2,60±2,54 (1,54-3,65)	3,4±2,78 (2,25-4,54)	0,147	1,20±2,17 (7,65-9,54)	0,8±1,87 (0,02-1,57)	0,244
Dress	8,00±2,22 (6,66-9,33)	8,20±3,18 (6,88-9,51)	0,413	5,00±4,08 (3,31-6,68)	4,60±4,06 (2,92-6,27)	0,364
Get ready	4,20±1,87 (3,42-4,97)	4,00±2,04 (3,15-4,84)	0,359	3,00±2,50 (1,96-4,03)	3,20±2,44 (2,18-4,21)	0,388
Deposition	9,40±1,65 (8,71-10,08)	9,80±1,00 (9,38-10,21)	0,153	7,60±3,85 (6,01-9,18)	8,20±3,18 (6,88-9,51)	0,275
Urination	8,00±2,50 (6,96-9,03)	8,60±2,70 (7,48-9,71)	0,209	4,6±3,79 (3,03-6,16)	6,80±3,78 (5,23-8,36)	0,022*
Toilet	7,40±4,11 (5,70-9,09)	8,00±4,08 (6,31-9,68)	0,303	4,00±4,33 (2,21-5,78)	4,60±4,06 (2,92-6,27)	0,307
Transfers	14,00±2,50 (12,96-15,03)	14,96±0,20 (14,87-15,04)	0,031*	9,20±5,71 (6,84-11,55)	8,80±6,65 (6,06-11,54)	0,410
Ambulation	14,00±2,04 (13,15-14,84)	14,96±0,20 (14,87-15,04)	0,012*	8,40±4,72 (4,44-10,35)	4,80±4,67 (2,87-6,72)	0,004*
Steps	3,00±4,08 (1,31-4,68)	3,60±4,68 (1,66-5,53)	0,315	0,80±2,76 (-0,34-1,94)	0,00±0,00 (0,00-0,00)	0,077
Total score	80,80±16,18 (74,12-87,47)	85,60±15,22 (79,31-91,88)	0,142	53,00±28,43 (41,26-64,73)	51,60±26,52 (40,65-62,54)	0,428

Abbreviations: DS: standard deviation; range (min-max) *Indepent t test were used $P < 0.05$ (with a 95% confidence interval) was considered statistically significant.

Discussion

In this study, by using the Barthel Index, we evaluated the ADL of patients who had suffer SARS-COV-2 infection. The Barthel Index is applied to evaluate 10 items of ADL in two to four stages; its efficacy is widely accepted (27,29,30). The Barthel Index is used to assess functional impairment resulting from multiple sclerosis, cerebrovascular accident, physical disability of the elderly and many other neurological diseases (27,31,32).

At the end of 2019 a new SARS-CoV-2 coronavirus it began to spread rapidly throughout the world, endangering the health of people around the planet (33). This new disease causes serious sequelae in 20% of affected patients, being necessary even, due to the respiratory problems in which the infection derives, admission to Intensive Care Unit (ICU) and even causing death (14).

Muscle weakness is one of the most frequent problems in patients with long bedtime periods and patients seen in Intensive Care units (34,35). Critical illness survivors experience marked disability and deficits in physical and cognitive function that can even persist for years after their initial ICU stay (36)

Disability acquired after ICU is associated with reduced health-related quality of life and a worsening in ADL (37).

Our study reveals that activities of daily living are reduced after suffering COVID-19, Iwashyna TJ et al. determined that after septicemia, older adults saw basic ADLs such

 doi:10.20944/preprints202105.0612.v1

as walking, bathing or dressing (38), our study reveals that COVID -19 infection causes a significant deterioration in all basic activities of daily life, eat, wash up, dress, get ready, deposition, urination, using toilet, transfers, ambulation, steps, if we compare the results of institutionalized elderly patients with the results of ADL before and after suffering COVID-19.

Sex and age are the main risk factors for COVID-19 disease (39) a study found that in similar age groups, the infection was more serious for men than for women (40) and it was men who had the highest mortality rate (41), these data would explain why after suffering COVID-19, men obtained worse results in the scoring of activities of daily living than women, despite having a lower average age.
However, the results before suffering the infection are worse for women, this would be explained because aging is the main cause of deterioration (42) and it is the group of women that has an average age greater than that of the men, 87.72 years, without forgetting that studies conclude that it is from the age of 80 when the death rate, higher than 95%, is more dramatic (43).

The emergency in the face of the COVID-19 pandemic, which is having a greater impact on older people and especially with institutionalized older people, is little studied in terms of the quality of activities of daily living post COVID-19. There are few reports evaluating the relationship between the Barthel index and sequelae derived from COVID-19. We found that the Barthel index, which is a simple and widely used method for assessing ADL, shows a significant correlation with the sequelae suffered by patients institutionalized who have suffered COVID-19 and the total results of the Barthel index and can potentially be used to predict the related quality of life after overcoming COVID-19. We believe that the use of the Barthel index is a useful tool to classify and quantify impairment in activities of daily living.

This study presents the limitation in the number of participants, but due to the unpredictability of the pandemic, there were not many elderly people who had Barthel performed 3 months before suffering the COVID-19 infection, without forgetting the dramatic mortality of the infection, higher 94%, which has made it even more difficult to increase the number of the study, since it was important to perform the Barthel in a small time frame and that other aspects, such as emerging diseases or improvements due to the rehabilitation of these subjects, were not influenced.

In summary, this study shows a significant reduction in the quality of activities of daily living, measured by the Barthel index, of the elderly instituted in two nursing homes immediately before and after suffering the COVID-19 infection, which should be taken into account to stop the impact that this infection is having not only on the health of our elders, but also on their day to day. It would be important for a multidisciplinary team to evaluate the deterioration of the daily life activities of the surviving elderly people, in order to establish an immediate and personalized rehabilitation plan, to not only preserve their health, but also the quality of life of these people after overcoming the disease.

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