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Functional dependency and COVID-19 in elderly patients with mild to moderate disease. Experience of tertiary geriatric hospital

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ARTICLE INFO

Section Editor: Daniela Frasca

Keywords:

Functional dependency

COVID-19 symptoms

Time to resolution of infection

ABSTRACT

Clinical course of COVID-19 may be associated with functional dependency of geriatric patients. Data from the records of patients admitted to the COVID-19 Geriatric Unit were gathered during three months, including background, clinical aspects, time to resolution of infection and functional status.

Functionally dependent patients had higher rates of diabetes ($p = 0.03$) and stroke ($p = 0.004$), as well as longer time to resolution of infection ($p < 0.001$), but less respiratory COVID-19 symptoms ($p = 0.007$), compared to independent patients. Time to resolution of infection was longer in women ($p = 0.01$) and positively associated with WBC level ($p < 0.01$) and age ($p < 0.001$). An adjusted analysis which controlled these variables confirmed the significant effect of functional status on the time to resolution of infection ($p = 0.015$).

Functionally dependent geriatric patients with mild to moderate infection had less respiratory COVID-19 symptoms but showed longer time to resolution of infection compared to independent. Assessment of functional status in the elderly population may contribute to decision making for care of geriatric inpatients with COVID-19.

1. Introduction

Older adults are particularly affected by Severe Acute Respiratory Syndrome - Coronavirus 2 (SARS-CoV-2), responsible for the Coronavirus Disease 2019 (COVID-19), which causes a broad spectrum of clinical manifestations, higher incidence of multi-organ dysfunction and mortality (Wu and Mc Googan, 2020; J. Yang et al., 2020; X. Yang et al., 2020). Eight of ten COVID-19's deaths are in patients aged ≥ 65 years (Centers for Disease Control and Prevention, 2020). This is not surprising, that geriatric patients are generally frail, cognitively impaired, bed ridden, suffer from decubitus ulcers and comorbid conditions. Chronic obstructive pulmonary disease (COPD), obesity, and diabetes mellitus have been shown to be associated with higher mortality risk, especially in COVID-19 cases (American Diabetes Association, 2018; Cortopassi et al., 2017; Kalish, 2016; J. Yang et al., 2020; X. Yang et al., 2020). However, elderly patients widely differ in their functional condition, which may be associated to both COVID-19 variants of course and mortality risk. While data about the association between functional and mental condition and the clinical profile of older adults with COVID-

19 is present in the literature (Aw et al., 2020; Azarpazhooh et al., 2020; Chen et al., 2020; Lian et al., 2020; Liu et al., 2020; Plotnikov et al., 2021; Wu and Mc Googan, 2020), the prognostic value of functional dependency on COVID-19 symptoms and time to resolution of infection is scarce. The aim of this study was to compare COVID-19 symptoms and time to resolution of infection between functionally dependent and independent geriatric patients.

2. Methods

This historical prospective study was performed in a 30-beds COVID-19 unit at Shmuel Harofe hospital, a geriatric medical center affiliated to Tel Aviv University Medical School (390 beds). Only mild to moderate symptomatic patients were hospitalized in our COVID-19 unit. Thus, patients with hypoxemia $< 94\%$ on room air or needed breathing support were not admitted.

COVID-19 diagnose was performed using reverse transcriptase polymerase chain reaction (RT-PCR) tests which is detected in samples from the throat and nasal swabs.

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<https://doi.org/10.1016/j.exger.2021.111620>

Received 3 August 2021; Received in revised form 31 October 2021; Accepted 2 November 2021

Available online 3 November 2021

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Data was collected from the electronic medical records of the patients (N = 98) hospitalized in the COVID-19 Unit during three months; July–September 2020. The data included background, medical history, routine treatment, clinical presentation and condition, laboratory tests at the day of hospitalization, and outcomes of COVID-19 RT-PCR tests.

The functional status was evaluated at admission by the nursing team according to the Functional Independence Measure (FIM) (Granger et al., 1989). The FIM evaluation is commonly used to rate the patients' performance with 5 cognitive and 13 motor items. The total FIM scores fall in the range between 18 (indicative of a total functional dependency) through 126 (showing a total functional independency). Accordingly, functional dependency is rated dependent/non-dependent by the attribution of points for each of seven activity daily living (ADL) functions: walking, bathing, dressing, toileting, transfer, continence and feeding. Patients with and without severe functional dependency were defined according to the FIM scores; patients with cut-point score of 72 were defined as functionally dependent (FDP) if FIM < 72, and non-functionally dependent patients (NFDP) if FIM ≥ 72.

COVID-19 diagnose was based on the Xpert Xpress test on Gene Xpert Dx Instrument Systems, Cepheid. This molecular in vitro diagnostic test aids in the detection and diagnosis of RT-PCR COVID-19 in separate throat and nasal swab specimens. The samples were collected and placed into a transport tube, mixed and transferred to the sample chamber of the Xpert Xpress RT-PCR COVID-19 cartridge for automated sample processing and detection of viral RNA.

In the study period of COVID-19 outbreak in Israel throat and nasal swabs for RT-PCR COVID-19 were collected one week after the initial positive test. In case of a negative outcome, an additional swab was taken 72 hours thereafter and in case of a positive outcome the next swab was taken after 7 days. Time to resolution of infection was defined as the number of days from the date of the first positive test to the date of the second consecutive negative PCR results (i.e., effective negative). Later, from November 2020, the discharge criteria were changed and based on ten days from the beginning of COVID-19 infection and symptoms only, while the PCR test was no longer applied.

2.1. Statistical analysis

Bivariate associations were tested using Pearson correlations, chi-square, and *t*-tests. An adjusted analysis of the time to resolution of infection performed using an analysis of covariance (ANCOVA). Possible confounders were added to the analysis according to their associations with both the dependent variable and the main factor (functional status). The threshold significance of confounders' associations was set on a significance of $p < 0.1$. Statistical significance was defined according to $\alpha = 0.05$, two-tailed. Analysis performed using SPSS 25 software (IBM Inc.).

3. Results

The patients were mostly women 54 (65%), average age was 84.5 ± 7.1 years (mean \pm SD). According to functional status, measures 54 patients (55%) were FDP and 44 (45%) NFDP. FDP were older (88.2 ± 3.9) compared to NFDP (80.0 ± 7.6) ($t = 6.9$, $df = 96$, $p < 0.001$). A higher rate of women (67.2%) compared to men (32.4%) ($\chi^2 = 10.9$, $df = 1$, $p = 0.001$) was in FDP group.

Higher rates of diabetes and post stroke patients were seen among FDP. In addition, among FDP more frequent use of beta-adrenergic blockers and hypnotic drugs and lower rates of statins and acetylsalicylic acid were recorded (Table 1). The total number of comorbidities did not differ between FDP (5.4 ± 3.3) and NFDP (4.6 ± 2.8) patients ($t = 1.3$, $df = 96$, $p = 0.19$).

The frequency of respiratory COVID-19 signs and symptoms were lower in FDP (1.3 ± 1.3) compared to NFDP (2.1 ± 1.5) ($t = 2.8$, $df = 1$, $p = 0.007$); cough ($p < 0.01$) and breathlessness ($p = 0.02$) (Table 2).

The time to resolution of infection was longer in FDP (43.7 ± 10.6

Table 1

Clinical data of functionally dependent and non-functionally dependent patients.

	FDP ^a n (%)	NFDP ^b n (%)	χ^2 , p
<i>Disease</i>			
Hypertension	35 (64.8)	27 (61.4)	0.12, 0.7
Diabetes mellitus	29 (53.7)	14 (31.8)	4.7, 0.03
Dementia	23 (42.6)	15 (34.1)	0.7, 0.39
Hypercholesterolemia	19 (35.2)	15 (34.1)	0.01, 0.9
Osteoporosis	14 (25.9)	11 (25.0)	0.01, 0.9
Cerebro-vascular accident	18 (33.3)	4 (9.1)	8.1, 0.004
<i>Drugs</i>			
Beta-blockers	27 (50.0)	13 (29.5)	4.2, 0.04
Proton-pump inhibitor	24 (44.4)	12 (27.3)	3.1, 0.079
Angiotensin converting enzyme inhibitors	18 (33.3)	14 (31.8)	0.03, 0.89
Benzodiazepines	17 (31.5)	13 (29.5)	0.04, 0.84
Diuretics	18 (33.3)	10 (22.7)	1.3, 0.25
Cholesterol lowering	3 (5.6)	14 (31.8)	11.7, 0.001
Acetylsalicylic acid	2 (3.7)	12 (27.3)	11.0, 0.001
Hypnotic	18 (33.3)	7 (15.9)	3.8, 0.049

^a FDP - functionally dependent patients.

^b NFDP - non-functionally dependent patients.

Table 2

COVID-19 signs and symptoms of functionally dependent and non-functionally dependent patients.

Symptoms	FDP ^a n (%)	NFDP ^b n (%)	χ^2 , p
Cough	10 (18.5)	20 (45.5)	8.3, 0.004
Headache	6 (11)	3 (6.8)	0.5, 0.46
Taste and smell loss	5 (9.3)	3 (6.8)	0.2, 0.66
Weakness	14 (26)	14 (31.8)	0.4, 0.5
Breathlessness	5 (9.3)	12 (27.3)	5.5, 0.02
Fever	23 (42.6)	12 (27.3)	0.5, 0.46

^a FDP - functionally dependent patients.

^b NFDP - non-functionally dependent patients.

days) compared to NFDP (25.8 ± 16.5) ($t = 6.5$, $df = 96$, $p < 0.001$) (Fig. 1). In addition, it was longer in women (38.7 ± 15.8) than men (29.9 ± 15.6) ($t = 2.6$, $df = 96$, $p = 0.01$), and positively associated with age ($r = 0.47$, $p < 0.001$) and WBC level ($r = 0.30$, $p < 0.01$).

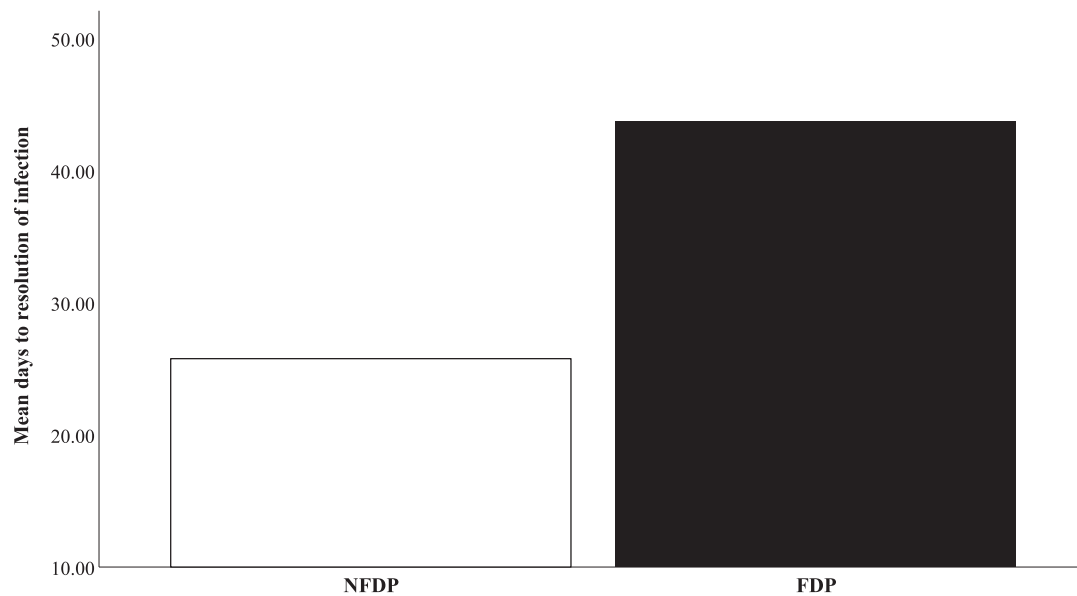
An adjusted ANOVA model with the main factors of functional status (FDP, NFDP), and sex, age and WBC as covariates, performed on the time to resolution of infection, indicated a significant effect of functional status ($F = 6.2$, $df = 1,78$, $p = 0.015$). No other significant main effects were found. No significant functional status by sex interaction was indicated ($p = 0.83$).

4. Discussion

This study compared COVID-19 symptoms and time to resolution of infection according to the functional status of geriatric patients. The main finding was that FDP with mild to moderate infection had less respiratory COVID-19 symptoms, such as cough and dyspnea compared to NFDP. The second main finding was that FDP had longer time to resolution of infection compared to NFDP.

It is well known that age can make the diagnosis more complex, as older adults with infections frequently have atypical manifestations (Gómez-Belda et al., 2020; Limpawattana et al., 2016), that make common infections, such as pneumonia less likely to present with classically recognized features (e.g., cough and sputum production), and they more commonly present with a change in cognitive (e.g., confusion) or physical function (e.g., inability to perform ADL or falls) (Ber-man et al., 1986; Deandrea et al., 2010).

The high rate of atypical presentations for a general medical patient cohort, aged more than 80 years presenting to an emergency



* NFD – Non- functionally dependent patients

Fig. 1. Mean days to resolution of infection among NFD and FDP patients. NFD – non-functionally dependent patients. FDP - functionally dependent patients.

department, observed by Hofman et al. (2017). Ming Gan et al. (1971) concerning presentations of COVID-19 old age patients, described similar findings. The most common atypical presentation reported was weakness, demonstrated in our study too, but there was no difference in both groups. Those finding suggests, that the physiological response of older adults towards COVID-19 may be parallel to that seen in other disease processes.

Resembling to our study Ming Gan et al. (1971) showed the increased numbers of patients with underlying dementia and high pre-morbid clinical frailty scores seen in atypical presentation group.

This is well known that aging COVID-19 patients with multiple comorbidities had a more prolonged recovery time (Atkins et al., 2020; Hewitt et al., 2020; Tenforde et al., 2020; Wang et al., 2020; Wei et al., 2020). In our study we shown that in addition to comorbidity and age, functional status has an additional role in duration of time to resolution of infection even in mild-to-moderate patients. Furthermore, despite the fact that there were a significantly higher number of diabetes and stroke patients in FDP group, the functional status was statistically significant independent predictor for recovery.

Additional interesting finding of this our study was a clear association with age and prolongation of time to resolution of infection within FDP group, this is opposite to our previous study (Lubart et al., 2021), where the age was not associated with the time to resolution of infection. Plotnikov et al. (2021) study showing, that chronological age should not be used as a sole prognostic factor for elderly patients with COVID-19.

Reports of long-lasting COVID-19, the so-called 'long COVID', are rising but little known about prevalence, risk factors or whether it is possible to predict a protracted course early in the disease (Anthony et al., 2021; Sudre et al., 2021). Long COVID characterized by symptoms of fatigue, headache, dyspnea and anosmia and was more likely with increasing age and female sex. We found in our study that functionally dependency was a predictor of long-lasting time to resolution of

infection.

5. Conclusion

While FDP with mild to moderate infection had less respiratory COVID-19 symptoms compared to NFD, they had longer time to resolution of infection. Among patients with COVID-19, severe functional dependency was found to be a better predictor of the time to resolution of infection than COVID-19 symptoms. Assessment of functional status may contribute to decision making for care of older inpatients with COVID-19.

5.1. Limitation

The present study had several limitations. First, it was a historical prospective study with its inherent difficulty in limiting the exposure to bias, and missing data may have affected the results. Second, the data is from a single center, and its findings could be different in other settings. Third, the study included a relatively small cohort of patients. Last, we cannot provide data on COVID-19 treatment because the patients were in mild or moderate condition and did not get any special anti-COVID-19 treatment.

The study and the manuscript were prepared in compliance with ethical standards. The study has ethical approval.

It was prospective historical study and there was not needed informed consent of participants.

Funding

No funding in this study.

Declaration of competing interest

No conflict of interest.

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