Maturitas 177 (2023) 107800

Contents lists available at ScienceDirect

Maturitas

journal homepage: www.elsevier.com/locate/maturitas

Short communication

Investigation of the relationships between frailty, nutritional status and muscle strength and the incidence and severity of Covid-19 among the residents of nursing homes. Results from the SENIOR cohort

Céline Demonceau *, Fanny Buckinx, Jean-Yves Reginster, Olivier Bruyère

WHO Collaborating Center for Epidemiologic aspects of musculo-skeletal health and ageing, Division of Public Health, Epidemiology and Health Economics, University of Liège, Avenue Hippocrate 13, CHU Bât B23, 4000 Liège, Belgium

ARTICLE INFO

Keywords:
Covid-19
SENIOR
Frailty
Malnutrition
Muscle strength

ABSTRACT

Few studies have investigated the factors associated with the incidence of Covid-19 in nursing homes. The aim of this study was to investigate the relationships between frailty, nutritional status, muscle strength and the Covid-19 incidence and severity in nursing home residents. Data from the last two years of follow-up of the SENIOR (Sample of Elderly Nursing homes individuals: an Observational Research) cohort were used. A total of 75 participants of the cohort were included, 56 % of whom had Covid-19. After adjustment for covariates, no association was found between frailty, nutritional status or grip strength and the incidence and severity of Covid-19.

1. Introduction

The Covid-19 pandemic created an extraordinary context in which some populations were quickly identified as being at higher risk to develop severe forms of Covid-19 and/or as having higher mortality rates, such as older people, and in particular nursing home (NH) residents.

Frailty, malnutrition and lower muscle strength are common in older people. All these three components have been widely studied in the literature in older people and have been shown to be significantly associated with the Covid-19 incidence and severity [1]. However, few studies have considered the specific case of older people in NHs. During the different waves of the pandemic, NHs closed their doors to outsiders to protect their residents. Data collection in this context was therefore extremely complicated.

The main aim of this study was to investigate the association between frailty, nutritional status, muscle strength and the incidence of Covid-19 in NH residents using data from the SENIOR (Sample of Elderly Nursing Home Individuals: An Observational Research) cohort [2]. Secondary objectives were to assess the association between frailty, nutritional status, muscle strength and Covid-19 severity as well as the impact of 2-year changes in these factors on Covid-19 incidence and severity.

2. Methods

This study used the data from the last two years of follow-up of the SENIOR cohort (2018 and 2019). Frailty was identified using Fried's criteria, nutritional status was assessed using the Mini Nutritional Assessment Short Form (MNA-SF) and muscle strength was measured using handgrip strength. Retrospective Covid-19 data were obtained from medical records in 2022. Symptom severity, collected in patients' medical records, was categorised as asymptomatic/moderate (i.e., fever, cough, dyspnoea, anosmia, diarrhoea, pneumonia) and severe/death (i.e., oxygen saturation $\leq$ 94 %, respiratory rate $>$ 30 breaths/min, lung infiltrates $>$ 50 %, need for nasal oxygen, fluid infusion or hospitalisation). Gender, age, number of comorbidities and medications, body mass index (BMI; kg/m^2), cognitive status (MMSE), activities of daily living (Katz), physical abilities (SPPB) and the level of physical activity (Minnesota questionnaire) were collected from the participants' medical records and considered as potential confounding factor. All eligible participants were vaccinated against Covid-19 in accordance with the procedure introduced in Belgium. Therefore, vaccination status was not considered a confounding factor. Univariate regressions, expressed as odds ratio (OR) and its confidence interval (IC95%), were first performed. Significant variables and all variables with a *p*-value below 0.10 in the univariate analyses were included in logistic regression models,

* Corresponding author.
E-mail address: celine.demonceau@uliege.be (C. Demonceau).

https://doi.org/10.1016/j.maturitas.2023.107800
Received 6 April 2023; Received in revised form 26 June 2023; Accepted 13 July 2023
Available online 20 July 2023

Table 1
Association between the residents' characteristics in 2019 and the Covid-19 incidence ($n = 75$).

	Incidence of Covid		Univariate			Multivariate [a]	
	Covid + ($n = 42$)	Covid − ($n = 33$)	OR	IC95%	P-value	OR	IC95%
Age, years	86.78 ± 9.99	87.27 ± 9.76	0.99	0.95–1.04	0.83		
Gender, women	31 (73.8)	25 (75.8)	0.90	0.31–2.57	0.85		
Comorbidities per individual	4.10 ± 1.92	3.19 ± 2.76	1.19	0.97–1.47	0.10	1.15	0.92–1.45
Body Mass Index, kg/m^2	28.61 (24.43–33.31)	23.93 (21.30–29.51)	1.08	0.99–1.19	0.08	1.07	0.98–1.17
Number of medications per individual	13.43 ± 4.27	11.15 ± 5.56	1.11	1.00–1.23	0.05	1.07	0.97–1.20
Frailty, /5 points	2 (1.25–3.0)	2 (1.0–3.0)	0.96	0.65–1.42	0.85		
Grip strength, kg	16.8 (12.5–23.1)	15.2 (11.7–27.7)	1.00	1.00–1.00	0.92		
Katz, score /32	15 (10.25–19)	13 (9–16)	1.07	0.97–1.17	0.18		
Mini Mental State Examination, /30 points	25 (19–27)	26 (23–28)	0.93	0.84–1.03	0.15		
Mini Nutritional Assessment, /14 points	12 (11−13)	12 (10−13)	1.15	0.92–1.45	0.22		
Short physical Performance Battery, /12 points	4 (2–7)	5 (1–7)	0.97	0.85–1.12	0.67		
Minnesota, kcal/day	490 (245–1470)	857.5 (245–1450)	0.99	0.99–1.00	0.96		

[a] Adjusted on comorbidities, Body Mass Index and number of drugs.

also expressed as odds ratio and confidence interval. All analyses were performed using R Studio version 4.1.2. and a p-value < 0.05 was considered statistically significant.

3. Results

The initial population of the SENIOR cohort in 2014 consisted of 662 NH residents. Among them, 191 were alive at pandemic onset in 2020. Of these, 2 were lost to follow-up due to a change of NH (1 %) and 83 were not assessed for frailty, malnutrition or low muscle strength in 2018 and/or 2019 (43.4 %). Data were not available for 31 individuals (16.2 %) for the assessment of Covid-19 incidence and for 75 individuals (38.7 %) for the investigation of Covid-19 severity.

A total of 42 residents were diagnosed with Covid-19 at least once (56 %). No significant differences were observed in the characteristics of residents in 2019 between those who contracted Covid-19 ("Covid +") and those who did not ("Covid −"). Univariate and multivariate regressions showed no association with Covid-19 incidence (Table 1).

In the univariate analyses, no significant association was observed between changes in patients' characteristics between 2018 and 2019 and Covid-19 incidence. However, in the multivariate regression, the MMSE score in 2018, used as a confounding variable, was associated with a decreased risk of contracting Covid-19 as the score increased (OR = 0.87 (0.77–0.98)).

Regarding Covid-19 severity, no association was observed between NH resident characteristics in 2019, the changes between 2018 and 2019 and Covid-19 severity. Multivariate regression was not performed because there were no variables with a p-value below 0.10.

4. Discussion

Our study did not show an association between frailty, poor nutritional status, low muscle strength and Covid-19 incidence and severity in NH residents. To our knowledge, this is the first study to investigate these associations in a population of NH residents.

Our findings are consistent with some of the literature. Indeed, a UK study showed no significant association between frailty and Covid-19 incidence in community-dwelling older people [3]. Similarly, a Belgian study of older people aged over 65 reported no association between nutritional status and Covid-19 incidence [4]. However, our results differ from other studies. In fact, a meta-analysis by Zhang et al. reported a 2-fold higher mortality risk in frail NH residents with Covid-19 compared to non-frail residents [5]. Moreover, Lengelé et al. reported a 7-fold higher risk of contracting Covid-19 in frail compared to robust older people [4]. Our findings also differ from the study by Kara et al., which observed that individuals with low grip strength had a 3-fold increased risk of developing severe forms of Covid-19 [6]. However, it is difficult to directly compare our results with these studies as they were conducted primarily in community-dwelling older people. Although no floor effect was observed in our sample in terms of activities of daily living in our sample, the NH resident population is specific and has specific characteristics, such as social status and drug consumption that could influence their health status. Although no floor effect in our sample in terms of activities of daily living was observed in our sample. In addition, some studies, such as the one of Lengelé, rely on self-reported incidence of Covid-19. In cases of asymptomatic or mild forms, participants may not have been tested, which could reduce the true incidence of Covid-19.

This study has some limitations that make it difficult to generalise our findings, in particular a limited sample size, missing data, a specific population that may not be representative of the NH residents, possible misreporting of data on Covid-19 in residents' medical records and the lack of some potentially confounding variables such as the effect of the NH structure.

In this study, the cognitive level in 2018 was associated with Covid-19 incidence. This finding must be considered with great caution as this confounding variable was not associated with Covid-19 incidence in 2019 or with the changes between 2018 and 2019. Furthermore, its clinical relevance is unknown.

In conclusion, the divergent results in the literature underline the need to remain cautious and to continue to consider older people, and particularly NH residents, as a high-risk population for Covid-19 and to continue to implement strategies to protect them.

Contributors

Céline Demonceau contributed to data collection, conception, design, statistical analyses, drafting and revision of the paper.

Fanny Buckinx contributed to data collection, conception, design, drafting and revision of the paper.

Jean-Yves Reginster contributed to drafting and revision of the paper.

Olivier Bruyère contributed to drafting, revision and supervision of the paper.

All authors saw and approved the final version and no other person made a substantial contribution to the paper.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval

This study was approved by the Ethics Committee of the Teaching Hospital of the University of Liège (reference 2013/178).

Provenance and peer review

This article was not commissioned and was externally peer reviewed.

Research data (data sharing and collaboration)

There are no linked research data sets for this study. The data are proprietary and cannot be shared.

Declaration of competing interest

All authors declare they do not have any other financial and personal competing interests with this paper.

References

[1] Y. Ma, L. Hou, X. Yang, Z. Huang, X. Yang, N. Zhao, M. He, Y. Shi, Y. Kang, J. Yue, C. Wu, The association between frailty and severe disease among COVID-19 patients aged over 60 years in China: a prospective cohort study, BMC Med. 18 (1) (2020) 274.

[2] F. Buckinx, J.L. Croisier, J.Y. Reginster, C. Lenaerts, T. Brunois, X. Rygaert, J. Petermans, O. Bruyere, Prediction of the incidence of falls and deaths among elderly nursing home residents: the SENIOR study, J. Am. Med. Dir. Assoc. 19 (1) (2018) 18–24.

[3] S.J. Woolford, S. D'Angelo, E.M. Curtis, C.M. Parsons, K.A. Ward, E.M. Dennison, H. P. Patel, C. Cooper, N.C. Harvey, COVID-19 and associations with frailty and multimorbidity: a prospective analysis of UK Biobank participants, Aging Clin. Exp. Res. 32 (9) (2020) 1897–1905.

[4] L. Lengele, M. Locquet, M. Moutschen, C. Beaudart, J.F. Kaux, S. Gillain, J. Y. Reginster, O. Bruyere, Frailty but not sarcopenia nor malnutrition increases the risk of developing COVID-19 in older community-dwelling adults, Aging Clin. Exp. Res. 34 (1) (2022) 223–234.

[5] X.M. Zhang, J. Jiao, J. Cao, X.P. Huo, C. Zhu, X.J. Wu, X.H. Xie, Frailty as a predictor of mortality among patients with COVID-19: a systematic review and meta-analysis, BMC Geriatr. 21 (1) (2021) 186.

[6] O. Kara, M. Kara, M.E. Akin, L. Ozcakar, Grip strength as a predictor of disease severity in hospitalized COVID-19 patients, Heart Lung 50 (6) (2021) 743–747.