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Nutritional Aspects in Patients with Covid-19 Admitted for Rehabilitation

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Abstract

Aim: As consequence of Covid-19 pandemic a large number of people were admitted to rehabilitation programs. Specific nutritional counseling and dietary advices for Covid-19 patients are not yet available with the exception of generally dietary recommendations. The scope of this paper is to characterize the possible role of nutritional aspects in patients with Covid-19 admitted for rehabilitation.

Design: Observational study.

Setting: Subjects hospitalized for severe bilateral pneumonia and admitted to rehabilitation setting.

Population: From March-2020 to May-2020, thirty-eight Covid-19-positive subjects hospitalized for severe bilateral pneumonia and admitted to rehabilitation.

Methods: All subjects were evaluated the first day of admission (T0). Clinical, anthropometric, biochemical (laboratory), and dietary data were recorded. Dietary intake was assessed through a detailed interviewer-administered food frequency questionnaire. In addition, was used the Malnutrition Universal Screening Tool (MUST).

Results: Patients' age ranged from 52 to 89 years (73.95 ± 8.27years). Eleven subjects were female and 27 males. All the patients were recognized to be at high risk of malnutrition at MUST: 9 subjects reported 2 points, 19 subjects 3 points, 8 subjects 4 points, and 2 subjects 5 points.

The Pearson's correlation showed a direct correlation between hemoglobin and protein total values r = 0.417 (p = 0.009) and between the 4-M Walk Test (WT4m) and the Barthel index r = 0.772 (p = 0.005); inverse correlation were found between Barthel index and age values r = -458 (p = 0.004) and between age and hemoglobin r = -420 (p = 0.009). Finally, in our samples the results showed an inverse correlation between C-Reactive Protein (CRP) and albumin with r = -0.592 (p < 001).

Conclusion: Our findings confirm the fundamental role of nutritional aspects in patients Covid-19 positive admitted for rehabilitation. We observed that all subjects have shown at the admission at rehabilitative setting a Medium/High Risk of malnutrition and a statistical correlation between nutritional Haematochemical tests, clinical features and inflammatory status. Further studies that include a larger sample size are needed to confirm our results.

Keywords

Coronavirus, Pulmonary and extrapulmonary inflammatory, Muscle weakness, Nutrition, Weight loss, Protein catabolism, Rehabilitation

Introduction

Starting from December-2019 a large number of people were rapidly infected by Covid-19 [1,2] although most patients infected are asymptomatic or develop mild to moderate symptoms (fever, myalgia or fatigue, and dry cough) [3] a subset of patients develops pneumonia and severe dyspnea, and requires intensive care [4-6] .In particular, the Covid-19 infection caused clusters of severe respiratory illness similar to severe acute respiratory syndrome (SARS) coronavirus and

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was associated with intensive care unit (ICU) admission and high mortality [7]. Covid-2019 is in particular characterized by an overexuberant inflammatory response [8]. Chen and colleagues have shown that elevated levels of serum inflammatory cytokines are correlated with severity of the disease in the blood of hospitalized Covid-19 patients [9].

As consequence of this pandemic a large number of people at discharge of ICU were admitted to respiratory rehabilitation programs [10,11]. The post-covid rehabilitation consists in a supervised program that includes exercise training, health education, behavioral intervention and breathing techniques to improve functional capacity, to reduce shortness of breath, to increase exercises tolerance, to a lesser extent, decreasing the number of hospitalizations and enhancing quality of life in subject with acute or chronic respiratory disorders [12,13].

Covid-19 infection is also a heterogeneous, complex and multisystem disease, with a very vast number of extrapulmonary inflammatory manifestations. Digestive symptoms as nausea or vomiting, diarrhea, and loss of appetite represent other significant symptoms for Covid-19 [14]. These extrapulmonary inflammatory manifestations may determine a possible malnutrition [15], mainly in elderly patients [16], in which a pathological change of the nutritional status is frequently associated with a decreased functionality [17]. Undernourished patients experience involuntary weight loss contributing to the worsening of frailty, including sarcopenia [16], to subsequent functional impairments that limit mobility [18]. Considering that fatigue is one of the most significant symptoms for Covid-19 infection, a possible malnutrition may further worsen the clinical status of these frail patients and influence the rehabilitative outcomes.

However, to our best knowledge, no study has ever reported the nutritional status in patients admitted for rehabilitation after Covid-19 infection. The European Society for Clinical Nutrition and Metabolism (ESPEN) expert statements and practical guidance for nutritional management of individuals with Covid-19 infection [19] recommends to assess presence of malnutrition and in rehabilitation to increase protein intake necessary to rebuild muscle mass.

Therefore, the scope of this observational study is to characterize the possible role and correlation of nutritional aspects in patients with Covid-19 infection admitted for rehabilitation.

Material and Methods

This observational study included patients consecutively admitted from March -2020 to May -2020 for post COVID-19 rehabilitation as inpatients to the Sant'Isidoro Hospital in Trescore Balneario (BG) because affected by severe bilateral pneumonia and being Covid-19-positive.

The post-covid rehabilitation treatment consisted in a supervised program of six sessions/week for 3 weeks lasted 3 hours split of exercise training, physical therapies, functional re-education, health education, behavioral intervention and breathing techniques.

Each patient was informed about the study procedure and aims. Then, after a period of discussion and reflection, each patient either enrolled voluntarily and provided written informed consent or declined to participate. This study was conducted in accordance with the amended Declaration of Helsinki.

Clinical and Nutritional Examination

All subjects were evaluated the first day of admission by a PRM doctor and a registered dietitian nutritionist. Clinical, anthropometric, biochemical (laboratory), and dietary data were recorded. All assessments were performed by subjects who was not aware of the research aims. Dietary intake was assessed through a detailed interviewer-administered food frequency questionnaire. In addition, we used the Malnutrition Universal Screening Tool (MUST), a useful nutritional screening test elaborated by the British Association of Parenteral and Enteral Nutrition (BAPEN) [20] (Table 1).

Data Analysis

The analysis carried out in this work is composed by two main steps. A box plot was utilized to detect the outliers. Normality of quantitative variables was assessed using the Kolmogorov-Smirnov test [21]. Descriptive statistics were represented in mean ± standard deviation (S.D.), median values, and frequencies [22,23]. Firstly, a Pearson's correlation, which measures a linear dependence between two variables, has been performed to estimate the mutual dependence between the variables.

Results

The studied sample was made of 38 subjects. All subjects completed the 3-weeks rehabilitative treatment period and fulfilled the assessment protocol at T0. No patient was excluded by the study because died or for other clinical reasons. General information, anthropometric, and dietetic characteristics of Covid-19 patients as well as the frequency are shown in Table 2. Patients' age ranged from 52 to 89 years. Eleven subjects were female and 27 males.

All the patients were recognized to be at high risk of malnutrition at MUST: 9 subjects reported 2 points, 19 subjects 3 points, 8 subjects 4 points, and 2 subjects 5 points.

The Pearson's correlation showed a direct correlation between hemoglobin and protein total values $r = 0.417$ ($p = 0.009$) and between the 4-M Walk Test (WT4m) and the Barthel index $r = 0.772$ ($p = 0.005$); inverse correlation were found between Barthel index and age values $r = -458$ ($p = 0.004$) and between age and hemoglobin $r = -420$ ($p = 0.009$). Finally, in our samples the results showed an inverse correlation between C-Reactive Protein (CRP) and albumin with $r = -0.592$ ($p < 0.001$) (Table 2).

Discussion

This is one of the first studies that describes nutritional aspects in patients with respiratory disorders for Covid-19 in a rehabilitative setting. Specific nutritional counseling and dietary advices for Covid-19 patients in rehabilitation setting

Table 1: Nutritional Assessment for Covid positive subject.

Name _____ Age_____

Malnutrition universal screening tool

Weight	Kg	Height	M	Body mass index (BMI)	Kg/m^2	
Unplanned weight loss in past 3-6 months	_____kg	Equal to	_____%	< 5%	< 5%	>5%
					< 10%	>10%
Acute illness (contribution reduction Food for more than 5 days)		Yes. impaired feeding / swallowing ability		No. for unimpaired feeding / swallowing ability		

Malnutrition risk	Low	Medium	Hight
Food	Oral so ministration	Nasogastric tube	Percutaneous endoscopic gastrostomy (peg)
Dysphagia	Yes	No	
Menu	Free	Solid	Semisolid

Haematochemical tests characterizing nutritional * and inflammatory status **

Hemoglobin*	g/dL	(cut-off < 13g /dL)
Protein total*	g/L	(cut-off < 6 g/L)
Cholesterol total*	%	
C-reactive protein (CRP) **	mg/dL	
Albumin**		

Nutritional Intervention ----------

Malnutrition Risk			**Intervention***		
Low			Amino Acids	Energy - Protein	Antioxidant-Anti-Inflammatory
Medium					
Hight					
Sarcopenia Risk	Yes	No			
Food	Free		Solid	Semisolid	
Dosage *					
Amino Acids	/Die			Time	
Energy - Protein	/Die			Time	
Antioxidant –Anti-Inflammatory	/Die			Time	

Table 2: Descriptive statistics.

	Age	**Height**	**Weight**	**BMI**	**Must Test**	**Haemoglobin%**	**Protein Total**	**Cholesterol Total**	**C-Reactive Protein**	**Album**	**Barthel Index**	**4-M Walk Test**
Mean	73.947	1.688	72.821	25.559	3.079	11.553	5.634	5.634	1.145	52.063	71.605	0.688
Std. Deviation	8.272	0.064	12.468	4.284	0.818	1.356	0.560	0.560	1.910	4.797	25.361	0.333

are not yet available with the exception of generally dietary recommendations [24-28]. The assessment of nutritional status is a fundamental approach to monitoring patients and avoiding complications in the hospital environment. Until now, the nutritional screening tools are based on anthropometric determinations, biochemical markers, clinical history, physical examination, dietary data and psychosocial features but apparently there is no optimal, universal and reliable nutritional status screening system for all metabolic conditions [29].

Nutrition is a “key element” in pathological progression of the major muscular, neurological and pulmonary diseases and the high impact on severity of the disease in the hospitalized subjects. As reported by Faverio, the nutritional status is important in the evaluation of patients; in particular, the progressive weight loss and reduction of muscle mass is important to predict the clinical course of disease [30]. It is well known that malnutrition has deleterious effects on lung and immune function, putting post Covid patients at increased risk for infections and respiratory failure [31,32]. Joa-

quin and colleagues reported that nutritional abnormalities are also caused by the interaction of different factors such as smoking, low physical activity, systemic inflammation, and an imbalance between caloric intake and energy expenditure, which induce protein catabolism [33]. Malnutrition may play an important etiologic role in anemia in the elderly [34]. In this study mean values of hemoglobin showed a general mild anemia. At the blood test results showed a significant correlation between hemoglobin and protein total values ($p = 0.009$), but not with albumin. Hemoglobin levels correlated inversely and significantly even with age and hemoglobin $r = -420$ ($p = 0.009$). This finding is consistent with the literature that describes hemoglobin levels that reduce with age, especially in those of age 80 and older [35]. To date, there is still no evidence about the real role of Covid-19 on changing these parameters. Finally, in our samples the results showed an inverse correlation between CRP and albumin with $r = -0.592$ ($p < 0.001$). Our data are in accordance with Liu and colleagues [36]: in particular the authors showed that C-reactive protein was significantly elevated, and the Albumin was significantly lower. Moreover, our data are similar to Menon and colleagues [37].These data support the hypothesis that the inflammation may be involved in the pathophysiological state of malnutrition.

Subjects with COVID-19 often become malnourished [38]. The impact of malnutrition on functional status in patients hospitalized in a rehabilitative department is a well-known problem and it has also been demonstrated that rehabilitative outcomes are influenced by nutritional status [39]. In elderly patients, malnutrition has high prevalence in rehabilitative settings and is associated with poor rehabilitative outcomes [39]. The Barthel index is one of the most widely used scales to measure performance in activities of daily living. Findings showed the Barthel index significantly correlated with the WT4m, and –inversely- with age.

Malnutrition may affect both gait and balance as a result of muscle weakness and the inability of the brain to deal with the associated sensorimotor and cognitive demands [40].

The main points that could be consider in order to provide a correct nutritional intervention in subjects Covid-19 positive may be as follows: the protein that made up muscles could be consumed by the acute inflammatory response of coronavirus infection [41-44]; angiotensin-converting enzyme 2 (the main target of Covid-19) is highly expressed in the gastrointestinal track with increment of diarrhea, abdominal pain, nausea, vomiting and poor appetite [45]. All these points may accelerate the occurrence of malnutrition in elderly patients with Covid-19.

Our results about MUST showed that all subjects included were affected by severe nutritional disorders. This finding is in line with the literature that describes a high percentage of patients affected by Covid-19 having severe nutritional disorders. Liu et al reported that more than 40% of their patients were screened by MUST as at nutritional risk [15]. In our case, the higher percentage detected can be explained by the fact that all of them patients passed a relatively long period of hospitalization in the acute ward to be before the transfer to rehabilitation.

This study has some limitations. The first is that we have not used here assessment tools for grading the severity of malnutrition. The second is the relatively small sample size.

In conclusion, our findings confirm the fundamental role of nutritional aspects in patients with Covid-19 admitted for post-Covid rehabilitation. In particular, we observed that all subjects have shown at the admission at rehabilitative setting a medium/high risk of malnutrition and a statistical correlation between nutritional Haematochemical tests, clinical features, and inflammatory status. Further studies that include a larger sample size are needed to confirm our results.

Clinical Rehabilitation Impact

Our data suggested that the evaluation of specific nutritional counseling and dietary advices in subjects Covid-19 positive admitted to rehabilitation program it is important to predict the clinical course of disease.

Authors' Contributions

P.S, C.M., A.P and G.F. contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

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