Geriatric rehabilitation and Covid-19: a Case Report

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Case Report

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Abstract

Introduction: Covid-19 infection has particularly affected older adults. Clinical observations in this population highlight major respiratory impairment associated with development or aggravation of frailty state.

Case Presentation: Mr P is a 93 years old frail patient, hospitalized after a COVID-19 infection. The assessment process of this patient has been supported by an innovative multi-systemic tool developed in view of the COVID-19 clinical consequences and a systemic evaluation of motor functions by the Frail BESTest. This process allowed presenting a mixed clinical picture associating an important respiratory distress (linked with the acute respiratory distress syndrome) and an evident motor frailty. The care plan was developed accordingly, and four assessment were done in the same manner until the return home of Mr P.

Conclusion: This case report allows seeing holistically a COVID-19 clinical picture, showing the different axis of clinical reasoning to enhance the rehabilitation process. Furthermore, this case report illustrate the importance of rehabilitation in the Covid-19 context.

Introduction

The COVID-19 pandemic targets aged adults, especially when they carry comorbidities [1]. In elderly adults, frailty corresponds to the clinical consequences of the physiological function decline, involving a pathological aging. Frailty is characterized by a loss of functional supplies, leading to a high risk of falls, of institutionalization, and sometimes of death [2]. Aged adults who survive the COVID-19 could present several frailty criteria after the respiratory distress and sometimes several days in an intensive care unit. Clinical pictures are multiples, associating respiratory and vascular consequences, bed rest effects, medication effects, in a psychological context of anxiety [3-4].

Case Description

The case report of Mr P is dedicated to underline the mixed clinical picture of an Acute Respiratory Distress Syndrome (ARDS) and a motor frailty. This case seems highly generalizable in the pandemic context where high age and associated diseases are major factors of death.

The 3 of March, 2020, Mr P. is hospitalized for a COVID-19 infection, confirmed by a thoracic scan showing the typical ground-glass opacities (Figure 1). His pulmonary function decreased, involving an oxygen supplementation of 15L/min. His clinical evolution confirms the oxygen dependency between 12 and 15L/min. Mr P is transferred in the rehabilitation unit the 04.22.2020. Mr P leaves alone in his house with a bedroom at the first stair. He is able to walk without technical support, inside and outside. During the examination, Mr P. clearly expresses that he want to go back at home, with his anterior functional level. An important fear of falling is noticed, measured at 15/28 with the short-FES [5]. Mr P also indicates that he
fell twice a year during 2019, when walking in his garden, and explains that he had difficulties to get up from the floor.

**Diagnostic Assessment**

We conducted the evaluation by a two filters analysis. The first one consists of evaluating the deficiencies linked with the COVID-19 infection and the associated ARDS, through a specific COVID-19 aggregation of scales. The second one targets the motor function using the Frail’BESTest [6] in order to orientate the clinical reasoning.

**Level 1: The specific COVID-19 evaluation**

In front of the heterogeneity of COVID-19 clinical pictures, we tried to propose a global summery including several clinical examinations. The available literature [7-8] spots a pulmonary typical deficiency associated with several new clinical scripts (ARDS, Psychomotor dis-adaptation syndrome, acquired pneumopathy, acquired neuromyopathy, etc.). The aggregation of scales was done in a transdisciplinary rehabilitation approach to screen all the important aspects consecutive to the infection. Tests were retained for their usability, their reliability and their validity.

- Social and behavioral functions are evaluated with the RAMSAY score [9] and the RASS scale [10].
- Some items of the Hamilton scale (HDRS) are used to measure the psychological and emotional state [11].
- The simplified cardiac and respiratory evaluation allows to measure the usual parameters with the mMRC dyspnea scale [12] and the Borg scale [13]. The peak cough flow rate (PCFr) is also measured [14-15].
- In accordance with the loss of mass frequently described [8], the body Mass Index is noted. Swallowing function is evaluated with simple tests.
- Frailty detection is based on several tests showing a good sensitivity : the gait speed measure [16], the chair test in one minute [17], the functional reach test [18] and the grip strenght test [19].
- Neuro-motor functions are evaluated by the PFIT-scored [20] and the MMRC [21-22]. A few items of the Mini Motor Test [23] and the BESTest [24] allow a large vision of the patient.
- A binary analysis of statesthesia and tact are proposed in addition to the other senses.
- About sensitivity, a double assessment including statesthesia and touch [25] is done.

The evaluation synthesis of Mr P is displayed on Figure 2a and 2b.

**Level 2: Reasoning with the Frail’BESTest.**

The Frail’BESTest has been developed to make it possible to include frail older adults when using a systemic evaluation [6]. Therapists can therefore directly manage therapeutic intervention for different
types of balance deficiencies. Overall, 6 sub-systems have been addressed: 1: anticipations, 2: reactions, 3: locomotion, 4: sensorial orientation, 5: biomechanical constraints and 6: asymmetric gait.

**Diagnostic**

Mr P, a 93 years old patient, presents a respiratory dysfunction linked with a Covid-19 infection (saturation at 91% with 7 liters Oxygen supplementation), subsequent effort incapacity, and posturo-motor deficiencies. Motor automatisms are impaired, and several articular and muscular constraints remain. Mr P seems enlisted in a frailty process, leading to an increased dependency, an impossibility to return at home, and a relative social isolation.

**Therapeutic intervention**

The protocol was carried out in agreement with legal and international requirements (Declaration of Helsinki, 1964). Mr P was informed about the publication project and gave their written consent before the evaluation.

Mr P followed a rehabilitation program which included mainly physical therapy and nutritional monitoring. He received one session of physical therapy per day. This session lasted in average 30 minutes. Considering the physiotherapy diagnosis of Mr P. as well as the age-specific lung physiology of the patient [26], some cardiopulmonary rehabilitation exercises allowing both maintenance of ventilator functions and the improvement of hematosis can be proposed. During all of these exercises, precautions, red flags and stop criteria indicated in the HAS Quick Response [27] should be followed.

The next paragraph will show the aims and exercises samples that have been proposed to Mr P. We would like to improve both transverse abdominis and diaphragm by active, functional and resistive treatment including threshold systems, hypopressive exercise and functional ventilation during efforts [28–30]. In order to limit physiological impairment, some exercises including thoracic movement with arms, chest and spine mobility are introduced during global therapy in both ways: inhale and exhale [31-32]. In order to improve oxygenation and prevent congestion, ventilation should be harmonized throughout the lung territories and mucociliary clearance should be promoted. Thus, high-volume ventilator-type work that includes tele-inspirational holds while avoiding the specific collapses associated with senescence. For example, exercises of type EDIC, ITLA (Inspiratory Technical for Lifting Atelectasis), Elpr, ACBT with open glottis are proposed [33-34]. Concerning rehabilitation with effort, it is necessary to increase the ventilatory threshold, to improve the muscular function and decrease dyspnea. This will also improve hematosis and oxidative metabolism. An early and progressive cardiopulmonary rehabilitation program is established and based on Borg scale [35-36]. For Mr P it includes optimal loading, aerobic work by paliers as well as endurance. This program mainly uses functional exercises such as treadmill walking (between 60-80% of the TM6 or of the chair-test or top toes test) [37]. It also seems important to prevent dysphagia in the medium term and to optimize the use of the functions of the nose (warm, filter and humidify the air). So, nasal ventilation and correction of the tongue position is essential. For example mindless nasal ventilation and tongue palate position is followed and lingual resistive exercise and sensitive work are proposed. In a
final perspective of patient's autonomy, throughout the rehabilitation, an education to the perception of effort, the use of the Borg scale, the self-assessment of his respiratory capacities and the criteria of alerts is carried out [38].

On the other hand, in connection with the systemic evaluation of the balance function and motor frailty of Mr P, several sensory-motor exercises are proposed. To improve the efficiency of posture-movement coordination, self-paced perturbations of balance were worked with speed and variability [39]. For example, Mr P. must reach a colored target on the ground as quickly as possible once the physiotherapist has indicated the color he has hit. To reactivate postural adaptations and fall avoidance reactions, Mr P performs exercises working on extrinsic imbalances (unpredictable balance perturbation [40]. For example, Mr. P had to react to manual pushes from the physiotherapist. In order to improve muscular power, functional muscular exercises were performed in a closed chain and with a time constraint [41]. For example, Mr. P had to go up and down a step to the beat of a metronome. In order to regain physiological ankle mobility and to enhance the rolling of foot during walking, active mobilization exercises were carried out during physiotherapy sessions and also by the patient independently in his room [42]. To reduce the podal dependency, Mr P performed static and dynamic balance exercises on different ground textures (e.g. standing on foam, walking on a mat, walking outside in the grass...). Finally, exercises integrating the work of spatial and temporal parameters of the walk and changes of direction were carried out. These exercises were aimed at improving walking kinetics and would participate in the evolution of the technical walking help.

**Follow up and outcomes**

The 4 assessments performed by the COVID-19 specific evaluation showed an overall improvement of the patient in several functions. In terms of psychological and emotional state, the anxiety with regard to oxygen dependence disappeared. Indeed, at the initial assessment the patient had 7L of oxygen in the high concentration face mask. At the final evaluation, he had only 1L of oxygen left in the nasal cannula. Pulmonary auscultation, which initially revealed a lack of ventilation associated with congestion of the middle and distal airways, also improved. Final auscultation is evaluated without particularities. The assessment of cognitive and behavioral functions remained unchanged over the course of the 4 assessments. Initial clinical observations did not show impairment of these functions. The initial preliminary assessment of the vascular and cutaneous system had shown the presence of a stage 1 pressure ulcer (National Pressure Ulcer Advisory Panel Stage Classification) behind the ears due to the oxygen mask. At final evaluation, the pressure ulcer was no longer present. No vascular disorders have occurred during the hospitalization. Moreover, there was no significant change in swallowing function, as Mr. P did not present any swallowing problems.

The changes in the scores of the quantitative outcomes of the different functions are summarized in Table 1.
$$\begin{array}{|c|c|c|c|c|}
\hline
\text{Section} & \text{Item} & \text{Evaluation n°1} & \text{Evaluation n°2} & \text{Evaluation n°3} & \text{Evaluation n°4} \\
\hline
\text{Date} & 27/04/2020 & 20/05/2020 & 29/05/2020 & 8/06/2020 \\
\hline
\text{Cardio-respiratory} & \text{Oxygenotherapy (L.min}^{-1}\text{)} & 7 & 2 & 1 & 1 \\
\hline
& \text{Dyspnea : mMRC score} & \text{rank 3} & \text{rank 3} & \text{rank 3} & \text{rank 3} \\
\hline
& \text{Dyspnea : Borg score} & 7/10 & 6/10 & 6/10 & 4/10 \\
\hline
& \text{SpO}2 \text{ (Oxygen saturation) at rest} & 91\% & 92\% & 92\% & 94\% \\
\hline
& \text{SpO2 after walking} & 84\% & 86\% & 88\% & 86\% \\
\hline
& \text{Respiratory frequency} & 24 & 22 & 20 & 19 \\
\hline
& \text{Chest expansion / Ventilatory assymetry (cm)} & 4 & 5 & 5 & 6 \\
\hline
& \text{Level of muscular strength} & \text{Diaphragm = 3/5} & \text{Diaphragm = 3/5} & \text{Diaphragm = 3/5} & \text{Diaphragm = 4/5} \\
& & \text{Transversus abdominis = 3/5} & \text{Transversus abdominis = 3/5} & \text{Transversus abdominis = 3/5} & \text{Transversus abdominis = 4/5} \\
\hline
\text{Frailty} & \text{Gait speed (m.s}^{-1}\text{)} & \text{NE} & 0,33\text{with rollator} & 0,4 \text{with rollator} & 0,57 \text{with rollator} \\
\hline
& \text{Grip strenght (kg)} & 26 & 30 & 30 & 32 \\
\hline
& \text{One min Sit to Stand Test} & 8 & 12 & 12 & 15 \\
\hline
& \text{FRT (cm)} & 20 & 20 & 21 & 23 \\
\hline
\text{Functional and neuromotor} & \text{PFIT-scored} & 5,9/10 & 5,9/10 & 6,4/10 & 7,1/10 \\
\hline
& \text{mMRC} & 44/60 & 50/60 & 56/60 & 56/60 \\
\hline
& \text{BESTest Ill-10 : Mounted on tiptoe} & \text{Score 2} & \text{Score 2} & \text{Score 2} & \text{Score 2} \\
\hline
\end{array}$$

**Table 1:** A summary table on the different evaluations with specific Covid-19 evaluation

The 4 assessments of Frail’BESTest show an improvement in the score of some subsystems. The results are summarized in Table 2.
| FrailBestTest | Initiale evaluation | Intermediate evaluation (number one) | Intermediate evaluation (number two) | Final evaluation |
|--------------|---------------------|-------------------------------------|-------------------------------------|-----------------|
| Date         | 27/04/2020          | 20/05/2020                          | 29/05/2020                          | 8/06/2020       |
| System A : Anticipations | 3               | 3                                   | 3                                   | 4               |
| System B : Reactions | 0               | 0                                   | 0                                   | 1               |
| System C : Locomotion | NE             | 1                                   | 2                                   | 2               |
| System D : Sensory orientation | 2           | 2                                   | 2                                   | 2               |
| System E : Biomechanical constraints | 2         | 3                                   | 3                                   | 4               |
| System F : gait symmetry | 4          | 4                                   | 4                                   | 4               |
| Total score | 11                  | 13                                  | 14                                  | 18              |
| Gait speed (m.s⁻¹) | NE            | 0,33 with rollator                  | 0,4 with rollator                   | 0,57 with rollator |

**Table 2:** A summary table on the different evaluations with FrailBestTest

**Discussion And Conclusions**

This case allows underlining the global approach that is necessary in a geriatric rehabilitation context associated with the COVID-19 infection. Although the long term follow-up is not yet available, it seems important to continue the clinical pictures description associated with this virus in order to better organize rehabilitation strategies. Indeed, the rehabilitation process represents the other challenge of the pandemic situation in several countries characterized by a high proportion of frail patients [43]. To our point of view, it is important to understand that the problem is not only to rescue a patient for its acute respiratory problem, but more to prevent the functional dependency associated with the infection consequences, especially in the Intensive Care Units where chronic diseases are frequently acquired.

Mr P was probably lucky to come back at home, with a high level of independency. His age and relative frailty were, at the beginning, considered as bad prognosis factors. As it is frequent in geriatric rehabilitation, age it is not only a question of number. In the same manner, frailty should not be questioned as an independence level, but more in terms of functional reserves. Mr P presented sufficient functional reserves, although he was certainly frail upon arrival at the hospital.

Several papers describe the physiotherapy associated with COVID-19 infection since the pandemic beginning. A lot of them described adults patients, often aged up to 65 years, considering the
respiratory/pulmonary rehabilitation. Strengths recommendations are available to manage these COVID-19 patients [8]. However, age and frailty are key factors to target the needs of these patients, and all our health systems should be adapted to the second wave of the pandemic situation: the rehabilitation wave [44].

Although a higher vulnerability of geriatric patients has been observed, the literature on aged COVID-19 patients has remained very scarce. A few studies adequately targeted these patients, and described interesting clinical pictures and associated medical treatments [45]. However, to our knowledge, this is the first case report highlighting the rehabilitation process with an aged COVID-19 patient who needs to be seen equally as a respiratory case and as a frail patient.

Declarations

- Funding: none

- Conflict of Interest: The authors state that there are no financial or personal relationships with other people or organizations that could inappropriately influence (bias) their work

- Ethical approval: The protocol performed in this case report is in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards

- Informed consent: Mr P was informed about the publication project and gave their consent

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**Figures**
Figure 1

Thoracic scan showing the typical ground-glass opacities
Figure 2

A. Part one of specific Covid-19 evaluation  
B. Part two of specific Covid-19 evaluation  
C. Part three of specific Covid-19 evaluation