Reporte de caso

Home-physiotherapy for a post-COVID-19 patient with PICS: Case report.

Fisioterapia en casa para paciente post COVID-19 con Síndrome Post Cuidado Intensivo: Reporte de caso.

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CONFLICTO DE INTERESES
Los autores del artículo hacen constar que no existe, de manera directa o indirecta, ningún tipo de conflicto de intereses que pueda poner en peligro la validez de lo comunicado.

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ABSTRACT
We describe a case of home-physiotherapy intervention supported by telemedicine for a post-COVID-19 patient with impairments associated with PICS. A 42-year-old male patient that was diagnosed with COVID-19 and stayed for 22 days in an Intensive Care Unit, developed impairments associated with PICS and was assigned home-physiotherapy sessions supported by telemedicine. A physiotherapist performed the intervention on the patient at home, following the instructions of another physiotherapist more experienced in post-COVID-19 patients and that was in another city. The physiotherapists were connected through a video call. The muscle strength in the four limbs increased from 3- to 4+, the dyspnea improved from 8 to 0, the functionality from 50 to 95/100, the anxiety from 9 to 6 and the depression from 9 to 1; SF36V2 domains improved 60%, except for limitations due to physical problems. Four weeks of home physiotherapy helped to reduce symptoms, and to improve exercise tolerance as well as daily living activities and quality of life. The home physiotherapy intervention used in this case, helped the post-COVID-19 patient to improve impairments associated with PICS, nevertheless, further studies with a longer follow-up period are needed to validate our results.

Key words: COVID-19, patients, physical therapy techniques, syndrome, telemedicine.

RESUMEN
Describimos un caso de intervención de fisioterapia domiciliaria apoyada por telemedicina para un paciente post-COVID-19 con deficiencias asociadas a Síndrome Post Cuidado Intensivo (SPCI). Paciente varón de 42 años, diagnosticado de COVID-19 e internado durante 22 días en una Unidad de Cuidados Intensivos, desarrolló alteraciones asociadas a PICS y se le asignaron sesiones de fisioterapia domiciliaria apoyadas por telemedicina. Un fisioterapeuta realizó la intervención al paciente en su domicilio, siguiendo las indicaciones de otro fisioterapeuta con más experiencia en pacientes post-COVID-19 y que se encontraba en otra ciudad. Los fisioterapeutas se conectaron a través de una videollamada. La fuerza muscular en las cuatro extremidades aumentó de 3- a 4+, la disnea mejoró de 8 a 0, la funcionalidad de 50 a 95/100, la ansiedad de 9 a 6 y la depresión de 9 a 1; Los dominios de SF36V2 mejoraron un 60%, salvo limitaciones por problemas físicos. Cuatro semanas de fisioterapia domiciliaria ayudaron a reducir los síntomas y a mejorar la tolerancia al ejercicio, así como las actividades de la vida diaria y la calidad de vida. La intervención de fisioterapia domiciliaria utilizada en este caso ayudó al paciente post-COVID-19 a mejorar las deficiencias asociadas con el SPCI, sin embargo, se necesitan más estudios con un período de seguimiento más prolongado para validar nuestros resultados.

Palabras clave: COVID-19, pacientes, técnica de fisioterapia, síndrome, telemedicina.

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INTRODUCCIÓN

Patients with severe disease due to COVID-19 often evolve with hypoxemic respiratory failure, and the ventilatory management in the Intensive Care Unit (ICU) is focused on the programming of protective ventilation, positive pressure titration at the end of expiration, and prone position.[1] In recent years there has been a growing interest in studying the impairments developed by survivors of critical illness, mainly muscle weakness acquired in the ICU (ICU-AW), anxiety and depression after ICU discharge and the post-traumatic stress syndrome.[2,3]

Post-Intensive Care Syndrome (PICS) is defined as "a new deterioration and/or worsening of some cognition proficiency, mental health and physical function after a critical illness and that persists beyond intensive care hospitalization".[3] Ohtake et al[2] and Demeco et al[4] have reported deficiencies in body functions and structures, activity limitations, and participation restrictions that are associated with PICS. The prevalence of physical deterioration associated with PICS is up to 80%, it includes muscle weakness, fatigue, and decreased exercise tolerance, among others, limiting activities of daily living and life quality.[5] Mental health is compromised between 8% and 57% of patients with PICS.[5] Considering the prevalence and magnitude of physical disability after a critical illness, patients who recover from COVID-19 may benefit from physiotherapy at home and outpatient settings after discharge from the hospital.[6-9] This report describes the home physiotherapy intervention supported by telemedicine for a post-COVID-19 patient that evolved with impairments associated with PICS.

Case description

The patient was a 42-year-old male from Cartagena-Colombia, with height of 1.68 m and weight of 90 kg, who upon admission to the hospital was reported to have an epidemiological link with his wife previously diagnosed positive for SARS-CoV-2. The patient stayed in ICU for 22 days, 14 days with invasive mechanical ventilation and three days in prone (Figure 1). Hospital discharged the patient after 33 days, and three days later he began home physiotherapy supported with telemedicine.

We found a conscious patient, oriented in the three spheres, time, person, and place, who perceived himself as "sad", and with a recognition of direct responsibility for his own recovery, moving in a walker assisted by the caregiver and with oxygen support at 3 bpm. The patient presented anxiety and depression, deficiency in aerobic capacity/endurance associated with deconditioning, muscle performance deficiency and posture deficiency, with limitations in daily living and basic day-to-day activities, and restriction in social, family, leisure, and work participation. Nevertheless, we identified environmental factors as facilitators, like access to medicine, close family support and good health services.

ETHICAL CONSIDERATIONS

This case report complies with the standards stipulated in resolution 8430 of 1993 of the Ministry of Health of Colombia, and with the Declaration of Helsinki. Written informed consent was obtained from the patient for publication of this case report.

CASE REPORT

Therapeutic goal

The patient was expected in the short term, with one session each day from Monday to Friday, to be able to carry out movements from place to place and ambulation without fatigue, favoring functional independence for the execution of activities of daily living (ADL).

Examination

We used HADS (Hospital Anxiety and Depression Scale) to identify the emotional state,[9] the Manual Muscle Testing (MMT) 9 to assess muscular strength, and functionally evaluated the ranges of joint mobility. Dyspnea was measured during rest and during exercise with the Borg scale, life quality with the SF-36v2 Health Questionnaire,[10] and the level of functionality with the Barthel Index (BI). We performed the MMT because hand dynamometers were unavailable and the Medical Research Council (MRC) scale is preferred for patients with ICU-AW.[9]

For the exercise capacity, due to the logistical conditions of the patient's residence, it was not possible to perform a six-minute walk test, so we evaluated walking around the room, progressing in time, and traveled distance. Table 1 describes the tests and measures according to the APTA categories,11 and the findings found in the initial evaluation, after 15 days and after 4 weeks of home physiotherapy supported by tele-expertise.

In Colombia, the Ministry of Health has defined tele-expertise as a category of telemedicine.[12] In this report, tele-expertise applies to the distance relationship between two physiotherapists to provide a health service, using information and communication technologies. In this case, a physiotherapist performed the intervention on the patient at home, following the instructions of another physiotherapist with more experience in post-COVID-19 patients and that was located in another city. The physiotherapists were connected through a video call with cellphones.

Treatment

After the initial assessment, the intervention plan focused on the recovery of function, which included muscle stretching, proprioception/balance work, strength/ resistance training in all

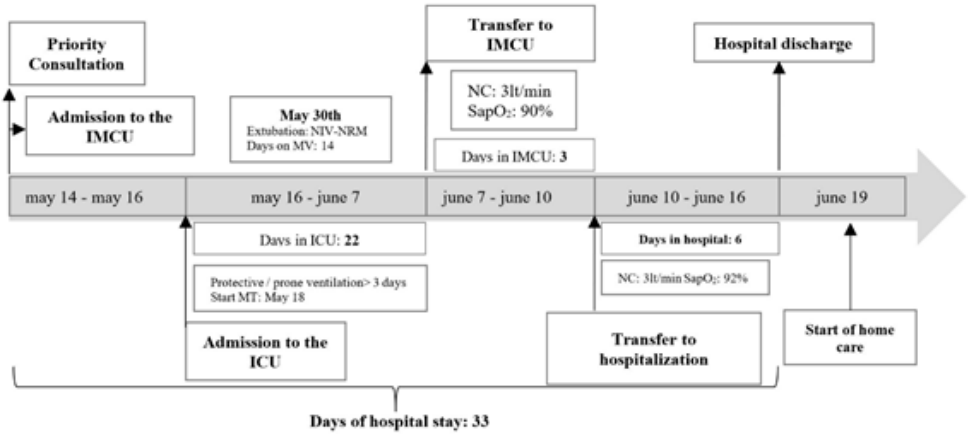

Figura 1. Timeline. ICU: Intensive Care Unit; IMCU: Intermediate care unit; NIV: Non-invasive ven-tilation; MV: Invasive mechanical ventilation; NRM: Non-rebreathing mask; NC: Nasal cannula; EM: Early Mobilization; SapO2: Saturation by pulse oximetry. Source: Self-developed.

four limbs, gait training, ADL, and patient and caregiver education; the intervention plan is described in Table 2. We chose the Proprioceptive Neuromuscular Facilitation technique (PNFT) because it facilitates intervention in functional movement patterns similar to those carried out in daily life and the rhythmic initiation technique.[13-15]

For the prescription of exercise, we established the intensity considering the dyspnea score between 4 and 6, beginning with an intensity of 50% of the maximum heart rate, until reaching 70% of it. The duration of the home physiotherapy session ranged between 90 and 120 minutes, alternating periods of exercise and rest with continuous monitoring of the response to exercise: rapid increase in heart rate, respiratory rate, blood pressure, increased dyspnea and drops in saturation. The physiotherapy sessions were carried out with continuous monitoring of Sp02 and heart rate. On weekends the patient was instructed to perform maintenance exercises that were scheduled according to the achievements made during the week.

Follow-up and evolution

The heart rate decreased from 112 to 88 bpm and the respiratory rate decreased from 23 bpm to 12 bpm from the first day of home physiotherapy to day 30th. Dyspnea was reduced from 8/10 to 0/10 with the intervention, and at the end of the first week it was possible to withdraw oxygen support while maintaining SpO2 greater than 94% in room air, achieving independent ambulation without oxygen. Regarding muscle strength, at the beginning of treatment the MMT showed a score of -3/5 for the upper and lower limbs that improved to 4/5 at the end of treatment.

In the psychological re-evaluation, the patient had a positive perception of himself that was evidenced in his speech, where he referred to his current state of health as “much better”. A clear desire to keep improving could be observed in the patient.

According to the HADS scale, at the beginning of the intervention the patient had a score of 9 in both anxiety and depression, which decreased to 6 and 1 respectively after one month, showing clinical improvement. The BI score on the baseline measurement was 50/100 (severe dependence), improving to 95/100 (mild dependence) at the end of 4 weeks. The patient improved his participation in self-care activities, and in leisure and free time activities; currently, he is expected to resume his productive activities in short time.

The quality of life evaluated with the SF-36v2 showed an increment of 45% in the domains of physical performance and vitality, 68% in mental health, and 20% in the perception of health in general. There also was a 36% reduction in limitations due to emotional problems, while limitations due to physical problems was the only category that did not show any improvement. During the training sessions the patient was collaborative, he had expectations, motivation, and he was participative in the activities with accompaniment of his relatives.

DISCUSSION

Considering the limited published reports on the treatment of impairments associated with PICS in post-COVID19 patients, this report describes clinical decision-making and achievements.

Table 1. Tests and measurements according to the APTA categories.

Categories	Tests and measurements	Findings		
Aerobic capacity / endurance	Vital signs	• First day • Resting heart rate • 112 bpm • Breathing frequency Resting 23 rpm • Blood pressure 130/80 mmHg	• 15 days • Resting heart rate 90 bpm • Resting breathing frecuency 18 rpm • Blood pressure 125/ 80mmHg	• After one month • Resting heart rate 88 bpm • Resting breathing frecuency 12-14 rpm • Blood pressure 120/ 78 mmHg
	Oximetry pulse	• Nasal cannula 3 bpm 92%	• Environment air Sp02 > 94%	• Environment air Sp02 > 96%
	Capillary edema and filling (sign of fovea)	• Bilateral malleolar edema (Grade II) • Present and symmetrical pulses	• Present, symmetrical pulses	• Presents symmetrical pulses
	Respiratory pattern	• Superficial upper costal predominance	• Of abdominal predominance	• Of abdominal predominance
	Auscultation	• Vesicular murmur decreased in left lung base	• Vesicular murmur decreased in left lung base	• Without alteration
	Borg scale	• Dyspnea at rest 8/10	• Dyspnea at rest 6/10	• Dyspnea at rest 0/10
Muscle performance	MMT	• 3- / 5 Upper and lower limbs	• 3+/5: Lower Limbs. • 3-/5: Dorsiflexors. • 3+/5: Upper limbs	• 3+/5 Lower and upper limbs
Range of motion	Functional joint mobility	• Limitation of flexion and ABD of shoulder above 90[a]	• Complete joint mobility arches	• Complete joint mobility arches
Posture	Description of static and dynamic alignment, including symmetry and deviation from the midline	• Dorsal kyphosis, pelvic retroversion, hip flexion, tilt to the left.	• Slight hip flexion persists, leaning to the left	• Dorsal kyphosis, pelvic retroversion.
Balance	Quantification of static and dynamic balance sitting and standing	• Altered static and dynamic balance	• Altered static and dynamic balance	• Static balance improved and dynamic remained altered, better torso control
Pain	Visual analog scale	• 6/10 muscle pain in gastrocnemius	• Muscular pain 4/10	• Absence of pain
Sensory integrity	Sensory processing	• Moderate paresthesia on the ulnar border of the left UL	• Mild paresthesia on the ulnar border of the left UL	• Intermittent paraesthesia
Mobility (locomotion)	Observations of mobility	• With full assistance (Walker) • With oxygen Less than 100 m Dyspnea 9/10 (Borg) • HR increase more than 50% from baseline • Alteration of the support and swing phase	• Assisted with caregiver. • Without oxygen • Tolerates more than 100 m • Dyspnea 6/10 • Continuous alteration in swing phase	• Independent walking • Without oxygen • Dyspnea of 4/10 • More than 300 -400 m • Tolerates 60% of maximum HR
Mental Function	Anxiety / depression scale HADS	• Anxiety: 9 • Depression: 9 • Range between 8 to 10		• Anxiety: 6 • Depression: 1 • Range less than 8 • Shows no risk for clinical anxiety and depression • Significant clinical improvement
Self-care and management at home, home and work and community, incorporation and return to work	SF 36V2	• Physical performance: 5% Limitation due to physical problems: 0% • Body pain: 0% • Functioning or social role: 0% • Mental health: 0% • Limitation due to emotional problems: 36% • Vitality, energy or fatigue: 25% • General perception of health: 40%		• Physical performance: 50% • Limitation due to physical problems: 0% • Body pain: 32.5% • Functioning or social role: 12.5% • Mental health: 68% • Limitation due to emotional problems: 66.7% • Vitality, energy or fatigue: 70% • General perception of health: 60%
	Barthel Index	• 50/100 • Severe dependent	• 65/100 • Moderate dependent	• 95/100 • Mild dependent

Source: Self-produced

Table 2. Intervention plan by weeks

First week			
Prescription	Intensity	•	Limited by symptoms. (dyspnea, fatigue) • 50% of maximum HR. (220-age)
	Duration	•	90-120 min (alternating exercise with long periods of rest)
	Frecuency	•	Once a day. Monday through Friday
Intervention	Emphasis was placed on anti-gravitational muscles, through the adoption and maintenance of posture (bridge, sitting and bipedal, progress was made in time, adding manual resistance). All interventions were performed accompanied by respiratory exercises		
	Strengthening of upper limbs	•	Diagonal Flexion-ABD and RE (opening) using number of repetitions as a progression variable
	Strengthening of lower limbs	•	Flexor and extensor diagonals, using number of repetitions as a progression variable.
	Shoulder girdle strengthening	•	Scapular diagonals (anterior elevation, posterior depression, posterior elevation and anterior depression) In lateral decubitus.
	Gait training	•	With assistance, short trips. Initially walking around the room, progressing in time and distance traveled with a walker and to the tolerance of the user, emphasizing the phases of the gait and the determinants of gait.
	Muscle stretching	•	Hip flexors, hamstrings, gastrocnemius, head and neck
	Balance training	•	Static and dynamic (seated) • Destabilizing exercises in bridge, sitting, anterior, lateral and posterior movements
	Weight discharges	•	Bridge
	Transfer	•	Sitting on the edge of a chair
	Patient and caregiver education	•	The educational component was adapted to the social and cultural situation, information was provided about the disease, self-care, and methods to improve dyspnea.
Second - Fourth week			
Prescription	Intensity	•	Limited by symptoms. (dyspnea, fatigue) • 60-70% of Maximum Heart Rate
	Duration	•	90- 120 min
	Frecuency	•	Once a day. Monday through Friday
Intervention	Shoulder girdle strengthening	•	Scapular and pelvic diagonals in lateral decubitus
	Strengthening of upper and lower limbs	•	D1 flexor - extensor; D2 flexor-extensor • Free exercises with resistance (Therabands) • Bicycle 15 to 30 minutes, interval mode starting with 30 seconds of work vs 30 seconds of rest
	Frequent activities in functional patterns	•	Walking on uneven terrain • Arm and leg coordination activities during walking
	Blance training	•	Static and dynamic (seated) • Destabilizing exercises in bridge, sitting, anterior, lateral and posterior movements
	Weight discharges	•	Bridge
	Transition from seated to biped	•	“Sitting up and standing up”
	Gait training	•	Without assistance, longer distances within tolerance. progressing towards prescription of going up and down stairs
	Muscle stretching	•	Neck, spine, hip flexors, gastrocnemius, hamstrings
	Patient and caregiver education	•	The importance of physical activity was emphasized

Source: Self-produced

The intervention was not based on a specific predetermined set of planned interventions or protocols, but rather on the individual assessment of the patient’s deficiencies. In this case report, notable improvements were obtained with a 4-week intervention. It is possible that more significant positive results could be obtained if the intervention was administered for a longer duration. Although we found an improvement on the patient’s health conditions, our results cannot be extrapolated to the entire post-COVID 19 population yet, and more research is needed to develop best practices in this area. Much remains to be learned about the recovery of post-COVID-19 patients who develop impairments associated with PICS.

During the term of the health emergency derived from the COVID-19 pandemic, the Colombian authorities decreed the use of technological platforms with basic audio and video that would

allow remote diagnosis and monitoring of patients.[16] A recent publication by Lee[17] discuss the use of telemedicine strategies in the rehabilitation of post-COVID-19 patients, and although in our environment it is still scarce, the use of telemedicine in the modality of tele-expertise and according to our results, facilitates follow-up and reduce trips to outpatient care centers, hence, decreasing the risk of contagion.

Physical function, emotional well-being and quality of life of COVID-19 survivors can be compromised.[18] However, there are still no publications to our knowledge that propose novel physiotherapeutic intervention techniques that favor the recovery of physical function in patients with post-COVID-19 with impairments associated with PICS. There are many factors that can cause alteration in the different axis systems of human body movement in COVID-19 patients admitted to the ICU, among which are sedation and the use of neuromuscular blockers, prolonged mechanical ventilation, isolation, lack of active movement and alterations in the level of consciousness, which generate disability, mental health problems and/or new or worsening cognitive deficiencies,[19] as identified in this case report.

Considering the above, for the approach of this patient with a hospital stay of 33 days, we proposed a home intervention based on PNF, since the use of a kinetic pattern allows isotonic and isometric contractions to gain strength, provides stability and joint breadth, and restores coordination and balance.13 PNF is currently used in the daily practice of physical therapy and represents a holistic approach that takes into account the therapeutic influence on the whole person, including mental and social spheres, rather than just the symptoms of the disease.[13,14] For De Santana Chagas et al[15] the importance of performance and functional expectations of patients reinforces the need for physiotherapy to be performed with an approach focused not only on the level of body structure and function, but also on the interaction with the components of the activity, participation and environmental factors such as contextual and personal, as highlighted by the ICF.[15]

Following the study by De Santana Chagas et al[15] here we used opening diagonals and the rhythmic initiation technique in the intervention plan, with the objective of promoting stretching of the intercostals and trunk extensors, favoring pulmonary ventilation and thoracic expandability, improving the perception of dyspnea. According to our results, we consider that there is a need for an interdisciplinary team for this type of patient.

Physiotherapists as professional experts in potentiating movement, can provide interventions in an effective way to optimize improvement in the physical functioning of patients, also favoring the improvement of mental and cognitive health problems that limit activities of daily life, restricting participation and negatively impact the quality of life of patients and their families.[2,3] Actions that can mitigate impairments associated with PICS should be considered, trying to maximize functional capacity, preventing secondary complications, and educating the family members and caregivers to allow the achievement of independence to resume activities and participation within their own environment.[20]

The identified strengths are related to a treatment proposal focused on the recovery of function, supported by telemedicine, as well as an individualized prescription determining the intensity, frequency, duration, and progression time of activities. The limitations are related to the lack of interdisciplinary work to guarantee comprehensive rehabilitative care, and the characteristics of the case reports.

Many critical patients who survive COVID-19 will evolve with impairments associated with PICS, therefore future studies should be carried out to support the rehabilitation processes in these patients. There is a scarce culture of identification, treatment, and monitoring of PICS in this field, so it is important to divulgate with the medical community and health entities the benefits of rehabilitation both in the acute and post-acute phases.[14,15]

CONCLUSIONS

The 4-week home physiotherapy program supported by telemedicine here presented, helped to improve impairments in the patient. These positive results showed that there is a need for us to develop evidence-based exercise protocols that will improve mobility, function, and quality of life in post-COVID-19 patients with impairments associated with PICS.

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