Postacute inpatient rehabilitation for COVID-19

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SUMMARY
This case describes the successful pulmonary rehabilitation of a premorbidly independent female in the early 80s who was admitted for acute respiratory distress syndrome secondary to COVID-19 requiring 14 days of intubation. Patient was admitted to the acute rehabilitation unit 1 month after hospitalisation. Patient initially had poor endurance and was only able to ambulate with a front wheel walker for 150 feet, and also had tachycardia and decreased oxygen saturation after ambulation. During patient’s rehabilitation course, therapy was focused on improving activity tolerance. Ten days after admission, patient was able to ambulate without an assistive device for 250 feet and with a rollator for over 900 feet. Patient also showed improvement in gait speed, heart rate, oxygen saturation after ambulation and incentive spirometer volume. This case demonstrates that pulmonary rehabilitation is an important component of inpatient care for patients with COVID-19 to improve functional exercise capacity and aerobic capacity.

BACKGROUND
The spread of the COVID-19 has brought about global pandemic resulting in unprecedented times for the medical and rehabilitation communities. According to the Centers of Disease Control and Prevention, older adults are at higher risk, where 8 out of 10 reported deaths in the USA have been in adults 65 years and older. Additionally, of adults with confirmed COVID-19 reported in the USA, 31%–70% of patients 65 years and older are hospitalised, 6%–31% are admitted to the intensive care unit and 4%–27% pass away. Unfortunately, patients who return home after prolonged hospitalisation are at high risk of several adverse health effects from decreased respiratory movement, muscle weakness, skin breakdown and decreased rate of metabolism. An observational, prospective, quasi-experimental study of 72 patients in Hainan General Hospital, China demonstrated that a 6-week respiratory rehabilitation course led to significant differences in pulmonary function tests and 6 min Walk Test (6MWT) and improved respiratory function, quality of life and anxiety in elderly patients with COVID-19. Therefore, given the severity of dysfunction seen in these patients with COVID-19, rehabilitation is essential and needed to optimise physical and cognitive functioning to reduce the risk of disability and morbidity.

CASE PRESENTATION
A premorbidly independent female in the early 80s with medical history of diabetes mellitus type II, hypertension and obesity presented to the emergency room after 8 days of fever, chills, cough and lethargy and positive outpatient COVID-19 test. Patient was admitted for hypoxic respiratory failure and pneumonia complicated by acute respiratory distress syndrome (ARDS) secondary to COVID-19 (figure 1). She required intubation for 14 days in the intensive care unit (ICU). During her stay, her arterial blood gas analysis showed mixed respiratory acidosis with metabolic alkalosis and her PaO2/FiO2 ratio of 35.5 mm Hg/0.4 was 89 mm Hg, suggesting severe, 43% mortality. Her qSOFA (quick Sequential Organ Failure Assessment) score was 2 for tachypnoea and hypotension, suggesting high risk for in-hospital mortality, though her full SOFA score was 6 for PaO2/FiO2 ratio of 89 mm Hg, platelets 100–149, Mean Arterial Pressure (MAP) <70 mm Hg and being on mechanical ventilation, suggesting <33% mortality.

Additionally, although patient has no history of any prior cardiac issues and thus no echocardiogram on file, she did have a troponia to 0.629 during her admission. Her ECG showed sinus tachycardia without stigmata of acute coronary syndrome and the troponin eventually downtrended to 0.115. Therefore, her troponia was concluded to be non-ST segment elevation myocardial infarction type 2.

After extubation, patient was downgraded to the telemetry floor for 14 more days. Patient slowly recovered after treatment with multiple medications, including hydroxychloroquine, azithromycin, ceftriaxone, vancomycin, cefepime, doxycycline.
and tocilizumab. One month after admission, patient was transferred to the Acute Rehabilitation Unit (ARU) after three negative COVID-19 tests while inpatient with goal of returning home with family.

Prior to admission to the ARU, patient’s Functional Independence Measure (FIM) scores were 5 out of 7 for bed mobility, transfers and ambulation with front wheel walker (FWW) to 150 feet which was limited by endurance. Patient was also noted to have a heart rate to the 130s and oxygen saturation of 88% after ambulation.

**OUTCOME AND FOLLOW-UP**

Table 1 lists patient’s scores for her functional outcome measures. For the Chair Stand Test, patient initially was only able to stand up eight times with hands pushing up from armrests in 30 s, however on day 10 she was able to stand up 11 times. Similarly, in her TUG test with FWW, she initially required 35.30 s to stand and walk 3 m and back, however on day 5 her time improved to 28.15 s. Her TUG test without assistive device also showed significant change, improving from 12.50 s on day 1 to 10.16 s on day 10, which suggests patient is no longer classified as high risk of falling in the community (>13.5 s).7 Lastly, patient’s 6MWT reflected 35.30 s and 0.44 m/s with FWW on day 1 and 150 feet with FWW on day 10 during her rehabilitation stay. Cardiopulmonary Exercise (CPX) testing was also considered for the patient to further evaluate her status, however the hospital’s CPX lab was unfortunately closed during that time due to COVID-19.

| Chair Stand Test | TUG test with FWW | TUG test without assistive device | Gait speed (15 feet) | 6MWT | Heart rate after ambulation | Oxygen saturation after ambulation (%) | Incentive spirometer volume (cc) |
|------------------|------------------|---------------------------------|----------------------|-------|-----------------------------|--------------------------------------|----------------------------------|
| Day 1            | Eight with hands pushing up from armrests | 35.30 s | 12.50 s | 0.44 m/s with FWW | 150 feet with FWW | 130 | 88 | 250–500 |
| Day 5            | Six with hands pushing up from armrests | 28.15 s | 12.50 s | 0.62 m/s with FWW | 722.4 feet with rollator | 105 | 94 | 500–750 |
| Day 10           | Eleven with hands pushing up from armrests | Not tested | 10.16 s | 1.04 m/s with rollator | 967.4 feet with rollator | 99 | 98 | 1000–1250 |

**TREATMENT**

During patient’s rehabilitation course, therapy was focused on improving activity tolerance and endurance. Patient’s functional outcome was measured with multiple assessments: The Chair Stand Test (30 s) measures the number of times a patient can stand up repeatedly from a chair in 30 s, the Timed Up & Go (TUG) test measures the time it takes for a patient to stand from a chair and walk 3 m away and back to sit down, and the 6MWT measures the distance an individual is able to walk over 6 min. These measures were recorded on days 1, 5 and 10 during her rehabilitation stay. Cardiopulmonary Exercise (CPX) testing was also considered for the patient to further evaluate her status, however the hospital’s CPX lab was unfortunately closed during that time due to COVID-19.

**DISCUSSION**

This was the hospital’s first case of successful pulmonary postacute inpatient rehabilitation in an elderly female patient after ARDS secondary to COVID-19 and intubation. Activity tolerance and endurance training were the most important factors for patient recovery given their association with pulmonary distress commonly seen in COVID-19 infections.8 The media focuses heavily on the disease process during its acute phase while patient is in the ICU or medical ward. However, this case report highlights that intensive pulmonary rehabilitation is also an important component of inpatient care for patients with COVID-19 in the postacute setting for maximal functional recovery in both exercise capacity and aerobic capacity.

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Reminder of important clinical lesson

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