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A Descriptive Analysis of Acute Occupational Therapy Services Following a Lung Transplant from COVID-19: A Case Report

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Abstract

Background

This case examines a 28-year-old female with a prior medical history of neuromyelitis optica admitted to our hospital in April of 2020 with acute hypoxemic respiratory failure secondary to COVID-19 pneumonia. This patient was the first person in this institution to receive a bilateral lung transplant due to COVID-19.

Methods

A retrospective chart review was performed with the patient's informed consent. We reviewed the patient's demographic information and occupational profile, medical and rehabilitation courses, and details regarding specific interventions performed.

Results

The patient was admitted to the medical intensive care unit, promptly intubated and sedated and remained so until after receiving lung transplant. Occupational therapy provided skilled services from postoperative day 4 until discharge to acute inpatient rehab on day 25. Patient received 19 therapy sessions targeting self-care tasks, balance, and functional transfers, among other interventions. The patient's functional performance was measured with the Activity Measure for Post-Acute Care (AM-PAC). This showed an increase in 9 points and correspond to a decrease in impairment by 56.46% over the 19 occupational therapy sessions.

Discussion

This case report describes the role of acute care occupational therapy in a patient who received the first bilateral lung transplant due to COVID-19 in this intuition. The patient exhibited significant improvement in functional status. They received early and frequent skilled occupational therapy services following a bilateral lung transplant.

Background

Between its first arrival in the United States and the end of 2021, the novel Coronavirus, SARS-CoV-2, and its resulting disease, Coronavirus disease 2019 (COVID-19) infected over 51 million Americans (Elflein, 2022). For cases in which the disease has progressed to a point in which recovery is deemed unlikely, lung transplantation has become an acceptable treatment option (Bharat, et al., 2020; Van der Mark et al., 2020).

There is limited research surrounding occupational therapy's (OT) role in the post-operative (post-op) stage of lung transplantations, and even more so in cases due to COVID-19. Although research related to COVID-19 continues to emerge, occupational therapy's role in evaluation and intervention of patient's status post COVID-19 lung transplantation appears undefined. In the time since this patient case, several studies have been published regarding occupational therapy, COVID-19 and functional implications of the virus. Patients diagnosed with COVID-19 have to endure physical, mental and cognitive impairments impacting their ability to return to premorbid roles and routines (Kim et al., 2020). With the acute respiratory distress syndrome (ARDS) population, hospitals have noted increased periods of time of mechanical ventilation and sedation have been linked with weakness, physical dysfunction and worsened cognitive status (Kim et al., 2020). For patients who survive acute illness, research has found long-term complications are frequently associated with major disability and extensive rehabilitation needs (Schweickert et al., 2009). Long-term complications from intensive care unit (ICU) stays, often labeled ICU acquired weakness, include myopathies and neuropathies, deconditioning, and loss of muscle

mass and strength (Candan et al., 2020). To counter ICU acquired weakness and major disability, interventions include aggressive early mobilization by services including OT in the earliest days of critical illness. Early mobilization practices have been identified as safe and well-tolerated, and they result in better functional outcomes for patients at hospital discharge, shorter durations of delirium, and more ventilator-free days when compared to those who experience long bouts of immobility while in the intensive care unit (Jette et al., 2003). In addition to facilitating early mobilization, OT in the acute care setting engages in evaluation and treatment of self-care ability and the patients' need for skilled assistance, which drives planning for discharge (Jette et al., 2014).

Aim

The aim of this single case report is to describe occupational therapy services provided and the rehabilitation course of this patient from admission to discharge.

Methods

This patient received rehabilitation services in an academic medical center. Informed consent was completed through the medical institution prior to review of the patient's case. The institutions IRB reviewed this case report submission and determined no further IRB review was required. The assigned ID to this review was STU00215449. Additionally, researchers sought out informed consent from the patient, the patient was educated in person on the aim and methods of this case report.

A retrospective chart review was completed to obtain the patient's demographic information and details regarding the therapy services and medical course of care. The course of rehabilitation was explored including the type, frequency, and duration of interventions provided. Other information gathered included frequency of specific

interventions, frequency of sessions per week between evaluation and discharge, and AM-PAC “6 clicks” Daily Activity Short Form scores from each session. Additionally, as part of this institution's documentation for OTs, assist levels were based on the Functional Independence Measure Instrument (FIM; Table 1).

Table 1

Functional Independence Measure (FIM) Instrument

Levels	Level Definition	Assist Level
7	**Complete Independence** (Timely, Safely)	No Helper Needed
6	**Modified Independence** (Device)	No Helper Needed
5	**Modified Dependence** Supervision (Subject = 100%+)	Helper Needed
4	**Modified Dependence** Minimal Assist (Subject = 75%+)	Helper Needed
3	**Modified Dependence** Moderate Assist (Subject = 50%+)	Helper Needed
2	**Complete Dependence** Maximal Assist (Subject = 25%+)	Helper Needed
1	**Total Assist** (Subject = less than 25%)	Helper Needed

Note. Keith et al., 1987

The AM-PAC “6-clicks” is derived from the Activity Measure for Post-Acute Care (AM-PAC). AM-PAC is a standardized functional assessment used in many acute care hospital systems. Both are scored using the same standardized metric (Jette et al.,

2003). The AM-PAC “6-clicks” utilizes direct observation and estimation of a patient's capabilities based on clinical judgment. Each item is scored on a four-point Likert scale, with a maximum score of 24 and a minimal detectible change of 5.49 (Jette et al., 2014). The higher the score, the higher level of functional independence the patient carries and thus influences discharge recommendation (Jette et al., 2014). This assessment reflects areas of functional engagement in ADLs, those of which are commonly assessed to guide post-acute care placement. The AM-PAC “6-clicks” is used as the preferred measure for this case report as this assessment was completed at the end of each OT session by every occupational therapist that worked with this patient. The AM-PAC “6-clicks” has demonstrated excellent test re-test reliability and interrater reliability, and additional studies have provided evidence of the “6-clicks” validity in the acute care setting (Jette et al., 2014; Shirley Ryan AbilityLab, 2022). This instrument was used to quantify the patient’s ability to perform six daily activities throughout their admission and track changes in functional ability by each OT who worked with this patient.

Finally, trunk control and balance were rated based on the Functional Balance Grades, a scale of Poor, Fair, or Good in accordance with documentation prompts (O’Sullivan et al., 2017; Table 2).

Table 2

Functional Balance Scale Score and Definition

Scale Score	Scale Definition
Normal	**Static:** Patient able to maintain steady balance without handhold support
	Dynamic: Patient accepts maximal challenge and can shift weight easily within full range in all directions
Good	**Static:** Patient able to maintain balance without handhold support, limited postural sway
	Dynamic: Patient accepts moderate challenge; able to maintain balance while picking object off floor
Fair	**Static:** Patient able to maintain balance with handhold support; may require occasional minimal assistance
	Dynamic: Patient accepts minimal challenge; able to maintain balance while turning head/trunk
Poor	**Static:** Patient requires handhold support and moderate to maximal assistance to maintain position
	Dynamic: Patient unable to accept challenge or move without loss of balance

Note. O'Sullivan, S.B. & Schmitz T.J., 2007

Results

Medical Course

The patient is a 28-year-old female with a prior medical history of neuromyelitis optica admitted to our hospital in April of 2020 with acute hypoxemic respiratory failure secondary to COVID-19 pneumonia. Additionally, the patient presented with hypoxemia, hypotension, unstable bradycardia, and hypothermia, found to be due to mixed septic and hypovolemic shock. Her pre-morbid functional status was independent in all

mobility tasks as well as with basic and instrumental activities of daily living. She was living an active and independent life and working full-time.

Upon admission, the patient was transferred to the medical intensive care unit (MICU), sedated, and intubated, requiring ventilator support on assist control (AC), 100% fraction of inspired oxygen (FiO2), and positive end-expiratory pressure (PEEP) of 15. On day 10 of hospitalization, the patient required cannulation for veno-venous extracorporeal membrane oxygenation (VV ECMO). The documented Richmond Agitation Sedation Scale (RASS) on this day was - 5, indicating an unarousable state of sedation. The patient was chemically paralyzed and remained critically ill in the MICU until ultimately undergoing a bilateral orthotopic lung transplant on day 40 of hospitalization. ECMO support was discontinued on post-op day (POD) 6 and her tracheostomy was decannulated on post-op day 16 (Table 3).

Table 3

Medical Considerations Over Course of Therapy Sessions

Week	Oxygen Delivery Method	Pain Rating (Chronologically Listed)	RASS Score
1	ECMO & trach to ventilator; trach to ventilator	Unable to Attend - 0/10	-1 to 2
2	Trach collar; High flow trach collar, Passy-Muir Valve	0/10 - 5/10	0 to 1
3	Room air; Nasal Cannula	4/10	-1 to 1
4	Room air	3/10-6/10	Not documented

Note. For some sessions, patient did not rate pain.

At this institution nursing and respiratory care staff were responsible for proning patients during this early phase of the pandemic. Nursing staff performed repositioning and assisted patient with self-care tasks. Care was coordinated to limit the number of

personnel entering a COVID-19 positive patient's room for safety and preservation of personal protective equipment. Due to the extraneous circumstances of the early phases of the pandemic, consults for allied health services were limited for those heavily sedated and on ECMO.

Consultation

The patient was first consulted for OT evaluation on POD 0. However, due to safety concerns with weaning of sedation, cognitive status and maintaining integrity of the patient's ECMO cannulas, evaluation did not occur until POD 4. Between day 0 and day 4, while therapy services were not yet initiated, the active consult allowed for the OTs to gather relevant information to initiate a plan of care. OTs monitored patient's vitals to further assess appropriateness for therapy including ECMO related considerations such as SWEEP and arterial blood gasses. OT engaged in interdisciplinary collaboration with ECMO specialist, nursing, respiratory therapy and physical therapy in order to develop a mobilization plan that maximized the safety of the patient. It is important to note the patient had abdominal and thoracotomy post-operative precautions guiding mobilizations techniques to maintain integrity of surgical sites.

Initial Evaluation

At the time of evaluation, the patient had been intermittently sedated and confined to bed for 45 days. Assessments performed during initial OT evaluation found significant impairments, with the patient demonstrating minimal spontaneous upper extremity movement, dependent with activity of daily living (ADL) engagement, and poor

trunk control. The patient also demonstrated ability to follow 25% of one-step commands within ability at this time.

Plan of Care

From evaluation to discharge, the intention of the OT plan of care was to re-build proximal strength and stability to provide a foundation for improvements in motor planning and further neuromuscular re-education. The use of basic ADL engagement in treatment facilitated an occupation-based approach, while also providing the patient with age-appropriate engagement in tasks previously performed. Specific OT interventions included re-positioning, early functional mobility and transfer retraining, preparatory activities, static and dynamic sitting and standing activities, self-care retraining such as brushing hair and teeth, and incorporating patient interests such as music and art project engagement.

Occupational therapy provided services for a total of 19 sessions over the course of 24 days. Session one encompassed the formal occupational therapy evaluation, with each subsequent session dedicated to treatment intervention. The initial frequency of visit was recommended to be five to seven times per week. In actuality, the patient was seen 4 to 6 days per week throughout hospital course (Table 4). Due to the patient's prior level of function and the progressive, functional gains, demonstrated throughout her hospital stay, OT recommended discharge to acute inpatient rehab after hospitalization.

Table 4

Occupational Therapy Plan of Care, Outcome Measures, and Interventions

Week	OT Visits (per week)	AMPAC "6-Clicks" Daily Activity	Summarized Interventions
1	3	6	● Educated and instructed on thoracotomy and abdominal precautions and application with mobility and self-cares ● Facilitated functional mobility specific to bed mobility (i.e., supine to sit, sit to supine, scooting and rolling) ● Engaged patient in static sitting balance at edge of bed with static activities and activity tolerance building up to 7 minutes ● Engaged patient in oral and facial hygiene ● Facilitated verticalization therapy with patient tolerating upright position for up to 18 mins, sessions completed with ECMO specialist and nurse present
2	6	10-11	● Facilitated communication board trial with use of built-up handle to trial writing ● Facilitated static and dynamic sitting balance activities, integrating dynamic reaching, patient tolerated up to 18 mins sitting ● Initiated hand strengthening (i.e., theraputty), active range of motion exercises, and strengthening program ● Initiated and instructed on diaphragmatic breathing education, engagement, and postural control exercises ● Facilitated weight shifting activity and education on importance of position changes when sitting in bedside chair to maintain skin integrity and prevent pressure wounds ● Led interdisciplinary education and collaboration with nursing staff to facilitate initial functional tasks and mobility to optimize activity tolerance for therapy sessions. ● Engaged patient in modified journal/daily routine log and reflection activity; identifying progress made within individual therapy sessions, writing down achievements as means of tracking progress toward goals and support
3	5	11-14	● Continued education and engagement in strengthening program including upper extremity, active assist range of motion,, Theraputty, lower body exercises in supine and chair ● Facilitated patient goal setting activity. Patient identified goals for therapy with desire to "walk and drink water." Assisted patient to identify short-term, realistic goals and attainable goals for day-to-day engagement (with or without staff assistance) for best success at achievement ● Provided education to family to assist with carryover of daily activity log ● Engaged patient in functional transfers including bed to chair (squat pivot), sit to stand, and stand to sit training ● Facilitated standing tolerance trials fluctuating from 10-25 seconds ● Instructed on sitting balance and trunk control activities, patient tolerating up to 40 minutes of sitting balance (static and dynamic), during self-care engagement ● Promoted engagement in pursed lip and diaphragmatic breathing for anxiety management ● Facilitated retraining of basic self-care activities including, grooming, toileting, lower body dressing
4	4	14-15	● Continued transfer training including commode transfers, stand pivot and sit to stand training ● Educated nursing staff on use of commode and functional mobilization during toileting and self-care related transfers ● Engaged patient in standing tolerance activities to promote functional mobility and self-care engagement ● Facilitated functional mobility activities specific to bed mobility (log roll, sidelying to sit, scooting) and ambulation for self-care preparation (1-3 feet) ● Facilitated retraining of self-cares specific to oral hygiene, face washing, lower body dressing (pants and socks) using of figure four positioning, upper body dressing, and toileting ● Educated on activity modification and environment modifications to optimize activity tolerance and safety when engaging in self-cares ● Promoted tabletop writing activity to document therapy achievements ● Educated on rehabilitation process post-acute care (i.e., acute inpatient rehab) and discharge planning and transition out of hospital

Patient Goals

On evaluation, the patient scored a 6 out of 24 on the AM-PAC “6 Clicks” Daily Activity Inpatient-Short Form, indicating 100% impairment. Due to the severity of functional impairment as demonstrated by the patient’s AM-PAC “6-clicks” score in relation to the patient's prior level of function, initial goals focused on sitting balance, trunk control, and basic ADL engagement. As the patient progressed, they expressed personal goals of wanting to “walk and drink water.” The patient’s OT goals were updated to optimize the provided level of challenge, and to reflect OT-related tasks that would help the patient achieve their personal goals. Updated goals throughout hospital course included basic ADL tasks such as lower body dressing and oral hygiene retraining as well as functional mobility goals such as sit to stand transfers, bed mobility, and toilet transfers.

Verticalization and Positioning

While the patient remained on ECMO, one of the first strategies used to assess and address tolerance to upright activity was through “verticalization” therapy. The patient’s bed was equipped with distinct features to be able to safely tilt the patient from supine into a simulated standing position thus “verticalizing” the patient. Once the patient demonstrated hemodynamic stability and tolerance verticalization, they were challenged to sit edge of bed, an incrementally appropriate next step in activity progression. On evaluation, the patient tolerated 18 minutes of verticalization, and required total assistance to engage in meaningful self-care and preparatory tasks such as face washing and bilateral upper extremity therapeutic exercises. Additionally, OT

initiated an order for pressure relief ankle foot orthosis (PRAFO) boots to ensure proper positioning while in bed.

Cognitive and Psychosocial Interventions

The patient's RASS score fluctuated from -1 to 2 throughout their intensive care duration in the hospital. During each session, OTs facilitated re-orientation activities. Additionally, occupational therapists provided education to the patient's family regarding delirium assessment, prevention, and management to maximize arousal and orientation while in the ICU. No additional RASS scores were documented after the patient transferred out of the intensive care unit. The patient continued to demonstrate improved orientation and consistent command following throughout the admission.

OTs consistently facilitated reflection activities with the patient. Practitioners engaged the patient in reflection on perceived progress in therapy sessions, specific to naming short-term accomplishments and identifying short-term goals for future sessions. Self-reflection tools and journaling were frequently utilized to support the patient's emotional and psychological wellbeing.

Preparatory Activities

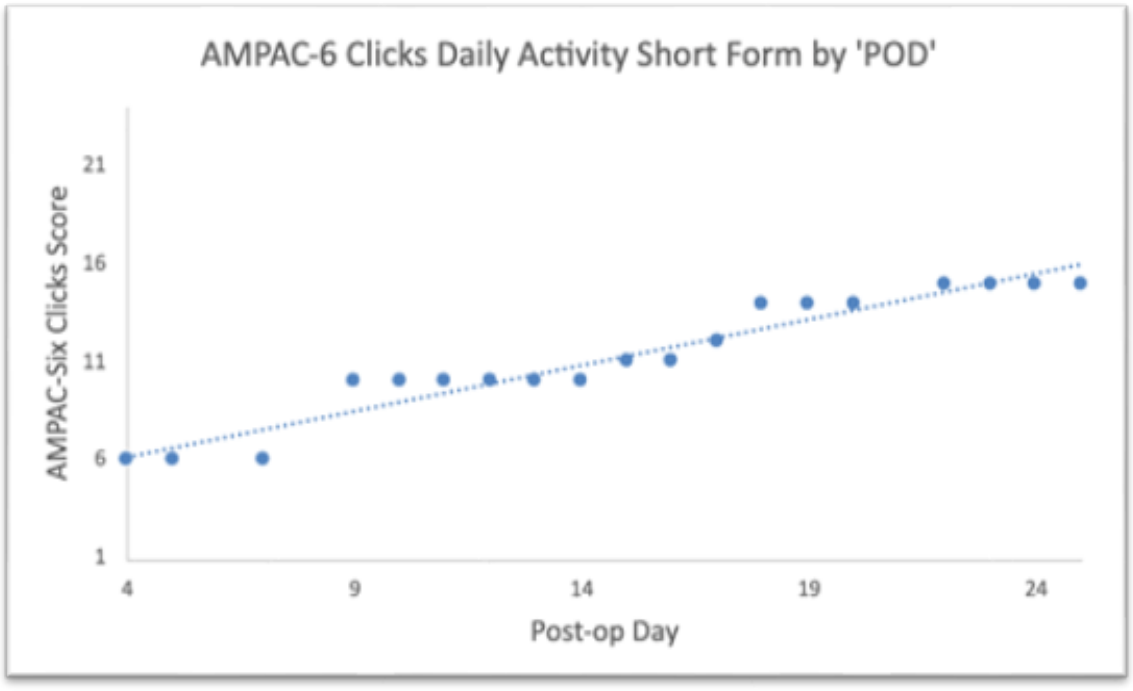
Of the total time spent with the patient, therapeutic activities such as sitting and standing balance tasks, transfer training, and other preparatory tasks made up the majority of interventions. OT utilized tasks to build a strong functional foundation through proximal stability, improved motor planning, and upper extremity strength and coordination to improve readiness for occupational engagement. When possible, occupations were encompassed within the session regarding patient interests.

Activities of Daily Living Engagement

Self-care tasks and occupation-based activities were used about a third of the time, were tailored to provide optimal challenge to the patient, and included dressing tasks, grooming, and toileting. At the last session prior to the patient's discharge from the acute care hospital, the patient's score on the AM-PAC "6 Clicks" Daily Activity Inpatient-Short Form was 15 out of 24. This showed an increase in nine points and corresponds to a decrease in impairment by 56.46% over the 19 OT sessions (Figure 1). This is a statistically significant change in functional status, as stated previously, MDC for AM-PAC "6 Clicks" is 5.49.

Figure 1

AMPAC 6-Clicks Daily Activity Short Form Score by Post-Operative Day (POD)



Discussion

This is a case report of a patient status-post bilateral lung transplant due to ARDS secondary to COVID-19. Pre-transplant, this patient required prolonged sedation and intubation, as well as support from ECMO. This resulted in a significant loss of functional status and independence. Following transplantation, the patient received early mobilization from occupational and physical therapies, and a continued high frequency of sessions until discharge. It is important to mention that this patient received physical therapy services at a similar frequency which likely contributed to the patient's functional improvements as well. Improvements in cognition, ADL participation, and overall functional status were positively correlated with continued participation in therapy.

This case demonstrates a strong improvement in functional status associated with early and frequent OT services following a lung transplant. The importance of structured opportunities for self-care tasks and daily routine cannot be understated and is a foundational cornerstone of the practice of OT. Recent research surrounding patients with ARDS due to COVID-19 has supported the use of ECMO as a means of weaning ventilator support (Mustafa et al., 2020). With this trend, functional participation in self-care tasks and ambulation with occupational therapists may continue to become more accessible for patients on ECMO.

Continued interdisciplinary collaboration is an imperative part of evidence-based, high-quality treatment. This is particularly important with high-risk patients requiring lifesaving procedures. With this case being novel in so many ways, outcomes were difficult to anticipate. With the unknown and unpredictable nature of COVID-19, the

occupational therapists in this case utilized evidenced-based practice shown to be effective in most transplant cases. These practices include early mobility both in the ICU and on stepdown units, progression in independent function (i.e., transfer, functional ambulation and self-care skills), and exercise training (i.e., aerobic, resistance, and flexibility training; Wickerson et al., 2016). Services primarily focused on providing interventions to improve functional needs and underlying impairments. Specific areas of need included bed mobility, self-care tasks, cognition, and physical impairments. In these cases, early, frequent, and aggressive OT has been shown to decrease the rate of delirium, improve long-term outcomes, decrease vent-dependent days, and decrease hospital length of stay (Schweickert et al., 2009).

Limitations to this case report exist. As a single case example, we cannot extrapolate the findings to all patients who have received a bilateral lung transplant. Measurable progress throughout the course of intervention was limited to the subjective reports of therapists, and the AMPAC “6 Clicks” was the only outcome measure repeated at each session. Any inter-rater reliability concerns are lessened by the fact that 16 of the 19 sessions were completed by the same occupational therapist. It would be beneficial to future clinicians providing care to this population to integrate additional outcome measures for tracking functional progress including, but not limited to, the rate of perceived exertion (RPE) scale, cognitive screening and assessments (domain and functional focused), quality of life assessments, or additional functional assessments. Further development of reliable and valid outcome measures appropriate for the acute care setting, patient populations such as transplant or COVID-19, and function are needed within future research.

Conclusion

The presented case report provides descriptive information regarding the acute phase of the occupational therapy process for a patient that received a bilateral lung transplant due to complications of COVID-19 ARDS. The findings and dissemination of this case report may inform occupational therapy practitioners on outcome measures, frequency, and interventions noted with this patient's diagnoses and functional considerations. With support from existing early mobilization literature, an aggressive course of occupational therapy was deemed most appropriate to support the attempt to progress this patient towards a return to independence and to maximize functional performance prior to discharge. Further evidence is needed to investigate the most effective occupational therapy interventions that can be provided to this novel patient population.

Practice Implications

- A collaborative approach between all health care members optimizes patient safety and functional progress.
- Building a therapeutic rapport with patient-centered goals facilitates trust and buy-in for patients experiencing complex and longer duration hospital stays.
- With patients having high acuity and medically complex needs, preparatory tasks and activities are an important building block toward functional progress in self-care occupations.

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